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PALESTINE
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A REVISION OF THE *CHENOPODIACEAE* OF PALESTINE AND NEIGHBOURING COUNTRIES

By A. EIG[1]

(With 7 figures in the text)

Beta vulgaris L. — Boiss. Fl. Or. 4:898.

PALESTINE: AP[2]: Haifa (1926 *Smoly*); S: Kabbara (1926 *FZ*); CS: Mikveh-Yisrael (1922 *E Faktorovsky*); EP: Balfourya (1924 *E*); CA: Wadi Shumriyeh (1928 Z); SA: Jenin (1911 *Dinsmore*); J: Hartuv (1926Z); JD: 15 km. E of Jerusalem (1934 *EZ*); UJ: Daganya (1924 *Smoly*); LJ: Env. of Jericho (1934 *EFZ*), Ein Gedi (1925 Z). SYRIA: About 10 km. W. of Souweida (1932 *EZ*). IRAQ: N Iraq: Shaqlawah (1933 *EZ*); S. Iraq: 94 km. SE of Baghdad (1933 *EZ*).

Chenopodium album L. — Boiss. Fl. Or. 4:901.

PALESTINE: J: Salomon's pools (1926 *E*).

Smoly); J: Kiryat Anavim (1926 Z); A: Amman (1927 *EFZ*). SYRIA: Maarat Naoman betw. Aleppo and Hama (1931 *EZ*).

Chenopodium album L. — Boiss. Fl. Or. 4: 901.

PALESTINE: AP: Haifa (1922 *E. Faktorovsky*); S: Hedera (1926Z); CS: Sarona (1924 E); UG: Beth Gan (1925 *E*); EP: Betw. Balfourya and Tel-Adashim (1926 Z); CA: Mt. Carmel near Haifa (1921 *E Faktorovsky*); UJ: Env. of Tiberias (1923 *E*). SYRIA: N. Lebanon: betw. Kefer Damine and Sahel Ain Tafikha (1934 *EFZ*); Nahr el Kalb (1924 *E*);

[1] Posthumous.

[2] The abbreviations given are to be read as follows:

DISTRICTS: A = Amman; AP = Acre Plain; AR = Wadi Araba; CA = Carmel; CN = Coastal Plain of Negev; CS = Coastal Plain of Shephelah; DA = Desert Part of Amman; DG = Desert Part of Gilead; E = Edom; EP = Esdraelon Plain; FN = Far Negev; G = Gilead; GO = Golan; HP = Huleh Plain; J = Judean Mountains; JD = Judean Desert; LJ = Lower Jordan Valley; M = Moab; NN = Near Negev; S = Sharon; SA = Samaria; SH = Shephelah; UG = Upper Galilee; UJ = Upper Jordan Valley.

COLLECTORS: *E = A. Eig; F = N. Feinbrun; Z = M. Zohary.*

Amanus Mountains, near Jebel Musa (1931 EZ); Amanus, Souklouk (1932 *Delbes*); Env. of Nahr Ibrahim betw. Tripoli and Beyrouth (1932 *EZ*); Kalaat Jindal (1929 *Gabrielith*). IRAQ: Env. of Rayat (1933 Z).

Chenopodium opulifolium Schrad. — Boiss. Fl. Or. 4: 901.

PALESTINE: AP: Env. of the Kishon River (1922 *E Faktorovsky*); LG: Kefar-Tabor (1924 Z); EP: Ein Harod (1924 *E*); UJ: Ayeleth Hashahar (1924 *E*). SYRIA: N. Lebanon: Env. of Ain Tafikha (1934 *Bot. Dept.*). TURKEY: Env. of Jemele, betw. Mersina and Fundakpinar (1931 *EZ*); Bulgardagh, env. of Biridglek (1931 *EZ*).

Chenopodium murale L. — Boiss. Fl. Or. 4: 902.

PALESTINE: AP: Haifa (1921 *E Faktorovsky*); S: Hedera (1926Z); CS: Tel-Aviv (1922 *EF*); CN: El-Arish (1925 *EZ*); UG: Wadi Dardara (1924 *Smoly*); EP: Beth-Alfa (1925 *E*); J: Jerusalem (1931 Z); JD: 24 km. E of Jerusalem (1934 *Boznier*); NN: Asluj (1929 *EFZ*); UJ: Tiberias (1934 *E*); LJ: Ein Gedi (1925 Z). IRAQ: Env. of Kuwaidba 35 Km. SW of Basra (1933 *EZ*).

Chenopodium urbicum L. — Boiss. Fl. Or. 4: 902.

SYRIA: Env. of Messaboun, about 30 km. W of Damascus (1931 *EZ*); env. of Dar'â (1932 *Dinsmore*). IRAQ: Iraqian Kurdistan: Env. of Rayat (1933 *EZ*). TURKEY: Env. of Alexandretta (1931 EZ).

Chenopodium Botrys L. — Boiss. Fl. Or. 4: 903.

SYRIA: Lebanon: Nahr-el-Kalb (1924 E). IRAQ: Iraqian Kurdistan: Ravanduz gorge (1933 *EF*); Sulaimani distr. Mergapan rocks (1933 *E Amdursky*); env. of Sursink, Dohuk distr. (1933 Z). TURKEY: S. Turkey: Bulgardagh: Env. of Biridglegh (1931 *EZ*); Bozanti, hills (1931 *EZ*); Goezne (1931 *EZ*). Amanus Mountains: Souklouk (1932 *Delbes*).

Chenopodium ambrosioides L. — Boiss. Fl. Or. 4: 904.

PALESTINE: AP: Jidro (1926 *EZ*); S: Banks of Yarkon (1924 *E*); CS: Tel-Aviv (1924 *E*); CA: Mt. Carmel (1924 *E*); J: Motza (1929 *A. Cohen*). SYRIA: Mt. Hermon: Hasbani (1924 *Smoly*). Lebanon: Nahr el Kalb (1924 *E*).

Chenopodium rubrum L. — Boiss. Fl. Or. 4: 905.

PALESTINE: UJ: Near the Jordan (1923 *E*).

Blitum virgatum L. — Boiss. Fl. Or. 4: 905.

SYRIA: Lebanon: Near *Cedrus* Forest of Bsharra (1931 Z); N. Lebanon: Kornet es Souda (1931 *EZ*); Hermon: Ain Jine (1924 *E*). N. IRAQ: Arl Ein Dagh (1932 *Guest*). TURKEY: Bulgardagh: Eastern slopes of Armadschek above al Kopru (1931 *EZ*).

Atriplex semibaccata R. Br. — DC. Prodr. 406.

PALESTINE: S: Hedera (1907 *Aaronsohn*); CS: Mikveh Israel (1935 *A. Cohen*).

Atriplex nitens Schkuhr — Boiss. Fl. Or. 4:908.

PALESTINE: SA: Nablus (1913 *Dinsmore*); J: Siloa, fields (1909 *Dinsmore*).

Atriplex patulum L. var. *palaestinum* Eig var. nov.

Folia oblonga vel oblongo-lanceolata, inferiora plerumque semihastata (unilateraliter hastata); inflorescentia longissima et laxa; perigonium fructiferum minutum (1 mm. rarissimo 3 mm. longum).

PALESTINE: AP: Haifa near the Kishon marshes (1925 *E Faktorovsky*); S: betw. Benyamina and Kabbara (1926 *FZ*); CS: Banks of Yarkon (1924 *E*); UJ: Banks of Jordan (1913 *Dinsmore*).

In some of our specimens nearly all the leaves are opposite (Kishon 1921, etc.), in others all the leaves are alternate, hastate or semihastate. All specimens, however, possess long and loose inflorescences, a minute, not tuberculate fruiting perigonium, with entire or almost entire margins.

Atriplex dimorphostegium Kar. et Kir. — Boiss. Fl. Or. 4:909.

PALESTINE: CN: El Arish (1925 Z); NN: Env. of Asluj (1936 *EFZ*).

Atriplex tataricum L. — Boiss. Fl. Or. 4: 910.

This species comprises an extremely polymorphous group of closely related forms or species exhibiting a wide range of ecological adaptation. The synonymy of this groups is confused so that the whole group has to be studied monographically. As to the material examined, it is opportune to make two remarks here: (1) In all forms (except the broad-leaved form of the Judean Desert and var. *tenerum*) the splitting of the bark of the shoot is a characteristic feature, which I have rarely or never seen in plants from other countries. (2) In the axils of their middle and lower leaves our specimens very often bear pistillate flowers, single or, rarely, in groups of 2—3. The bracts of these flowers are mostly more developed than those of the inflorescence proper. This has also been seen in certain non Palestinian specimens. The pistillate flowers are sometimes limited to the leaf axils only (and do not appear in the inflorescence) or they occur in a certain number among the staminate flowers. According to HEGI (Ill. Flora von Mittel-Europa, III: 247) dioecy seems to occur in this species; I, however, think that sex distribution here is more complicated.

It seems to me that in our material the type form of this species is not represented and that all our forms belong to a group centred by "var. *virgatum*" Boiss. The latter is conceived in a broad sense by different authors. The true var. *virgatum* seems to be represented in our material from Iraqian Kurdistan only. This is a very distinct form with entire or nearly entire, oblong-lanceolate or lanceolate leaves, virgate erect branches and spikes.

All other forms of our material constitute another group in which the lower leaves at least are ovate-oblong or ovate-triangular, with more or less dentate margins, while the middle and upper leaves are oblong-lanceolate or lanceolate and entire. Rarely are all the leaves more or less dentate or repand-dentate; the bases of the leaves are prominently cuneate, never hastate.

The following forms were distinguished by us in our Herbarium material from Palestine, Syria and Iraq.

Atriplex tataricum L. var. *virgatum* Boiss. — Boiss. Fl. Or. 4:910.

IRAQ: Kurdistan: Ascent from Sulaf to Amadie (1933 *EF*); env. of Rayat (1933 *EZ*).

Atriplex tataricum L. var. *hierosolymitanum* Eig var. nov.

Folia inferiora et plerumque etiam media cuneata, triangularia vel cuneato-ovata, irregulariter et profunde dentata, saepe in eorum axillis 2—3 flosculos femininos ferentia; spica longa (15—30 cm.), interrupta, flosculos masculinos et femininos vel solum masculinos ferens.

Palestine: J: Jerusalem (1930 Z): M: Kerak (1926 *E*). Syria: About 20 km. W of Karyatayn (1932 *EZ*).

The Jerusalem material is very homogenous; to the same phenotype belongs the material from Kerak; the specimens from Karyatayn though having longer and narrower leaves, must also be referred to this variety.

Atriplex tataricum L. var. *lasianthum* (Boiss.) Eig (= *A. lasianthum* Boiss.) — Boiss. Fl. Or. 4: 910.

Palestine: LJ: Wadi Zerka (1931 Z). Syria: Hermon: Ain Jine (1924 *E*).

The alpine form (specimens of Hermon) occupies a position intermediate between var. *virgata* and var. *hierosolymitana*. As to the specimens of Wadi Zerka we are not sure wether they belong to this variety.

Atriplex tataricum L. var. *desertorum* Eig var. nov.

Folia omnia cuneato-triangularia vel cuneato-oblonga, ± dentata; spica brevior; planta pumilior et minus ramosa.

This plant probably approaches at most the European forms of the species.

Palestine: JD: km 26 E of Jerusalem (1935 *EZ*); NN: Wadi Um-Rej (1934 *EFZ*); LP: Env. of Kalia N of the Dead Sea (1935 *EZ Grizi*).

The abundant material from Wadi Um-Rej belongs in my opinion to this variety, being more xeromorphic.

Atriplex tataricum L. var. *tenerum* Eig var. nov.

Folia tenera, viridia vel fere viridia, non farinosa, omnia aut cuneato-triangularia vel cuneato-oblonga, ± dentata aut oblonga vel ovato-oblonga, ± integra; spica brevis, densa.

A small mesophytic alpine form.

Syria: Hermon: Rashaye (1925 *E*).

Atriplex roseum L. — Boiss. Fl. Or. 4: 911.

Palestine: UG: Safed (1922 *E Faktorovsky*); J: Jerusalem, Mt. Zion (1929 *EZ*); UJ: Banks of Lake Huleh (1933 *E*). Syria: Coelesyrian Plain, betw. Cherbine and Hermel (1934 *Bot. Dept.*); Slopes of Makson-Nimr (betw. Damascus and Karyatayn) (1932 *EZ*). Hermon: Rashaye (1924 *E*).

This species is very constant in comparison with *A. tataricum.*

Atriplex portulacoides L. — Boiss. Fl. Or. 4: 913.

Palestine: AP: Acre (1926 *EZ*); Marshes of Kishon (1921 *E Faktorovsky*); S: Marshes of Kabbara (1925).

Atriplex parvifolium Lowe — Dur. et Barr. Fl. lib: 202.

Within this species *A. alexandrinum* Boiss. and *A. palaestinum* Boiss. must be included. After comparison of our abundant material of this species

with a few specimens only from N. Africa (Egypt, Tunisia, Algeria, Morocco), we have come to the following conclusions:

(1) *A. parvifolium* Lowe var. *palaestinum* (Boiss.) Eig (= *A. palaestinum* Boiss.) seems to be a good variety, based particularly on ecological but also on morphological characters. It is distinguished by its more whitish-mealy colour, by its generally denser spike; the tubercles of the fruiting perigonium, if present, are generally less prominent. The plant is less decumbent. Ecologically it is a typical Saharo-Sindian species.

(2) *A. parvifolium* Lowe var. *alexandrinum* (Boiss.). Eig (= *A. alexandrinum* Boiss.) is another variety, much greener in colour than the type and var. *palaestinum*. Its branches are more diffuse, prostrate and more slender. Ecologically it is rather a Mediterranean—Saharo-Sindian form. Further observations on this variety are needed.

(3) In addition, a third variety, *A. parvifolium* Lowe var. *confertum* Eig has been distinguished. It is, however, a doubtful form based mainly on its dense, nearly round or broadly ovate and minute leaves. Although very striking in its outer appearance it may be a simple modification caused by grazing. Further observation is called for to confirm the constancy of this form.

Atriplex parvifolium Lowe var. *palaestinum* (Boiss.) Eig (= *A. palaestinum* Boiss.) — Boiss. Fl. Or. 4: 914.

PALESTINE: CN: El Arish (1925 *EZ*); J: Jerusalem (1924 *E*); JD: Bir Ghuweir to Wadi Shukf (1926 *EFZ*); NN: Zuweira (1926 *Z*); LJ: Ras Feshkha to Jericho (1926 *EZ*); DA: El Muakkar to El-Kharani (1927 *EFZ*); M: Ziza to Qutrani (1929 *EZ*); E: El Hasa to Menzil (1929 *EZ*).

Atriplex parvifolium Lowe var. *confertum* Eig var. nov.

PALESTINE: JD: E of Beni Na'im (1934 *EFZ*); M: Env. of Basra (1924 *Braslavsky*); E: 13 km. W. of Ma'an (1936 *EFZ*). SYRIA: Syrian Desert: 50 km. E of Damascus (1933 *EZ*); Env. of Adra W of Dumeir (1933 *EZ*).

Atriplex leucocladum Boiss. — Boiss. Fl. Or. 4:915.

PALESTINE: U: El Arish (1925 *E*); J: Jerusalem (1937 *Z*) JD: Wadi Shukf to Wadi Sdeir (1926 *EFZ*); NN: Zuweira (1925 *Z*); UJ: Beth Shean (1934 *EFZ*); LJ: Jedeida (1926 *E*); M: Jebel es Suwaka (1936 *EFZ*); E: Wadi Ithm ca. 15 km. NE of Aqaba (1936 *EFZ*). SYRIA: Betw. Karyatayn and Havarin (1932 *EZ*) (intermediate between the type and var. *Ehrenbergii*).

This species has been described by BOISSIER in Diagn. Plant. Nov. (1853) on the specimens, probably all from Sinai, collected by BOVE, SCHIMPER and himself. BOISSIER designated the plant as "perennis, basi suffrutescens". Besides, he mentioned that the fruits were young, but did not give any details as to whether the fruiting perigonium was tubercled or not.

In the Flora Orientalis (1897) *A. leucocladum* is recorded as a shrub and its fruiting perigonium as having a smooth disk. Since our specimens are annual or perennial herbs and their fruiting perigonium is beset with rough and large tubercles, they do not agree with the above description.

Obviously BOISSIER in his Flora Orientalis changed this original description after having included within this species some Egyptian specimens collected by ASCHERSON and SCHWEINFURTH. In the authentic specimen of SCHIMPER I saw young fruits with initial tubercles overlooked by BOISSIER. On the other hand I have seen plants of this species, determined by SCHWEINFURTH, altogether devoid of tubercles.

From the above it follows that Palestine-Sinaitic plants probably differ from the Egyptian ones, the latter being shrubs or low-shrubs with a smoothe perigonium-disk.

After further elucidation of the problem it seems to me that one has to accept the opinion that the Egyptian specimen also belong to *A. leucocladum* Boiss. One must, however, reexamine the Egyptian material on the one hand and amplify the description of *A. leucocladum* according to the abundant Egyptian material on the other.

Another difficulty is presented by the fact that this species does not differ specifically from *A. Ehrenbergii* F. v. Muell. Authentic specimens under this name examined by me as well as other material present transitions towards *A. leucocladum*. *A. Ehrenbergii* thus can hardly be considered even a variety.

Atriplex leucocladum Boiss. var. *Ehrenbergii* (F. v. Muell.) Eig (= *A. Ehrenbergii* F. v. Muell.) — Boiss. Fl. Or. 4:915.

PALESTINE: JD: Betw. Mar Saba and Bir Ghuweir (1926 *EFZ*).

Atriplex Halimus L. — Boiss. Fl. Or. 4: 916.

PALESTINE: CS: Tel-Aviv (1923 *E Faktorovsky*); CN: El-Arish (1925 *EZ*): EP: Env. of Beth-Alfa (1924 *E*); JD: 18 km. E of Jerusalem (1934 *EFZ*); NN: Hafir (1928 *EZ*); FN: 30 km. NW of El Kuntilla (1936 *EFZ*); UJ: Deganya (1926 *E*); LJ: East of Jericho (1935 *E Grizi*); Massada (1926 *Z*); AR: Env. of Ain Hasb (1936 *EFZ*).

Atriplex Halimus L. var. *argutidens* Bornm. — Bornm. Mitt. Thuer. Bot. Ges. 30: 82.

PALESTINE: JD: Wadi Kelt (1911 *Dinsmore*).

Chenolea arabica Boiss. — Boiss Fl. Or. 4: 922.

PALESTINE: JD: Wadi Kelt (1934 *Boznier*); NN: Asluj (1929 *EZ*); FN: Betw. el Kuntilla and el Kusseima (1936 *EFZ*); Env. of Aqaba (1936 *EFZ*); LJ: env. of Jericho (1934 *EFZ*); DA: El Muakkar — el Kharani (1927 *EFZ*); M: Belka, Jebel as Suwaka (1936 *EFZ*); E: 14 km. W of Ma'an (1936 *EFZ*). SYRIA: 10 km. N of Karyatayn (1932 *EZ*).

Ch. arabica is the leading species of *Chenoleetum arabicae*, very characteristic of the Judean Desert.

Bassia monticola (Boiss.) Kuntze (= *Kochia monticola* Boiss.) — Fl. Or. 4: 925.

SYRIA: N. Lebanon: Foot of J. Matrafe (1934 *Bot. Dept.*); betw. the forest of Ehden and Talieh (1931 *EZ*).

Bassia muricata All. (= *Kochia muricata* Schrad.) — Boiss. Fl. Or. 4: 927.

PALESTINE: CN: El Arish (1925 *EZ*); NN: Beersheba (1929 *EZ*); FN: Kusseima (1929 *EZ*); LJ: Ghor es Safieh (1925 *Z*); E: Ma'an (1929 *EZ*). SYRIA: Syrian Desert: Betw. Wadi Sirhan and Rutba (1933 *EZ*).

Bassia muricata All. var. *brevispina* Bornm. — Bornm. Mitt. Thuer. Bot. Ges. 30: 82.

PALESTINE: CN: Rafah (1924 *E*); LJ: Ghor es Safieh (1925 *EZ*).

Bassia eriophora (Schrad) Kuntze (= *Kochia latifolia* Fres.) — Boiss. Fl. Or. 4: 927.

PALESTINE: JD: Wadi Shukf to Wadi Sdeir (1926 *EFZ*); NN: Ras-Zuweira (1926 Z); LJ: Ein Gedi (1926 *EFZ*); DA: El Muakkar to el Kharani (1927 *EFZ*).

Bassia eriophora (Schrad.) Kuntze var. *rosea* Eig. var. nov.

Folia floralia rosea.

PALESTINE: DA: El Muakkar to el Kharani (1927 *EFZ*).

Bassia joppensis Bornm. et Dinsm. — Fedde, Repert. Eur. et Med. I, 28: 484.

PALESTINE: Betw. Jaffa and Tel-Aviv (adventitious; *Dinsmore* n. 3865).

Arthrocnemum glaucum (Del.) Ung. Sternb. — Boiss. Fl. Or. 4: 932.

PALESTINE: AP: Jidro (1927 *Smoly*); S: Atlith (1935 *EFZ*); JD: Wadi Kelt (1925 Z); NN: Tel-Arad (1926 Z); LJ: Banks of Arnon River (1925 Z).

Salicornia herbacea L. — Boiss. Fl. Or. 4: 933.

PALESTINE: AP: Acre (1926 *EZ*); S: Atlith (1926 *EZ*).

Salicornia fruticosa L. — Boiss. Fl. Or. 4: 932.

PALESTINE: AP: Haifa, marshes of Kishon (1921 *E. Faktorovsky*); S: Kabbara (1925 *EZ*); JD: Wadi Kelt (1928 *Gabrielith*); UJ: Wadi Milh (1931 *EZ*).

Halocnemum strobilaceum (Pall.) M. B. — Boiss. Fl. Or. 4: 936.

S. IRAQ: Basra to Ez-Zubair; (1933 *EZ*); plain near Chankula (betw. Baghdad and Basra) (1933 *EZ*).

Hypocylix Kerneri Wol. (Stapf in Denkschr. Acad. Wien: 7 (1886). var. *syriaca* Eig. var. nov.

Fructiculosa, caulibus erectis, albidis, subglabris; folia carnosa, alterna, tetragona, linearia, 1—2 cm. longa, obtusa, mutica, subglabra, in axillis paulo lanata, flores in glomerulos 3—7-nis dispositi, spicas laxas, falcatas formantes; bracteae 1—3 foliis similes sed diminutae et ad basin concavo-dilatatae, caeterae minutae, semigloboso-concavae; bracteola una, raro duae; perigonii phylla ad basin coalita, ovato-concava, cucullata, 1,5 mm longa, membranaceo-marginata; staminodia quina, semiorbiculata, in discum staminiferum coalita; stamina quina; antherae oblongae, muticae, minutae; ovarium depresso-globulosum; stylus minutus; stigmata brevia, bina rarius trina, clavata, racurvata.

SYRIA: East of Karyatayn (1890 *Post*).

Suaeda asphaltica Boiss. — Boiss. Fl. Or. 4: 938.

PALESTINE: JD: 17 km. E of Jerusalem (1925 *EZ*); Wadi Kelt (1925 Z); LJ: Ein Gedi (1926 *EFZ*).

Easily distinguishable by its leaves, especially the upper ones which are clearly petioled, and by the flowers inserted on the petioles above

the axils. It is the leading species of the *Suaedetum asphalticae*, very characteristic for the Judean Desert and probably endemic there.

Suaeda fruticosa Forsk. — Boiss. Fl. Or. 4: 940.

PALESTINE: LJ: Ein Gedi (1931 Z); Kallia (1937 *E*).

This is one of the commonest halophytes confined to alluvial saline soils of the Lower Jordan Valley. It is a shrub nearly 1 m. high and intricately branched. The flowers are minute, arranged in groups mostly more than three in number and inserted in the axils of leaves. Young branches are pruinose-pubescent at the tip. Inflorescences loose. The mature fruits and the leaves are shed, while the dry branches remain on the plant for a long time. The name *S. fruticosa* is only tentative and deserves further confirmation by comparison with authentic material.

Suaeda vera Forsk. (= *S. fruticosa* auct. non Forsk.) — Boiss Fl. Or. 4:939.

PALESTINE: S: Caesarea (1926 Z); Kabbara (1925 *EZ*).

This is a Mediterranean plant, distinguishable by its dense, almost imbricated leaves, the very minute flowers, and the pear-shaped pistil; the style is dilated above forming a disk on which the stigmas (generally more than 3 in number) are inserted.

Suaeda monoica Forsk. — Boiss. Fl. Or. 4: 940.

PALESTINE: LJ: : Arnon (1936 *EF Grizi*); AR: Env. of Aqaba (1936 *EFZ*); E: Ma'an (1929).

Rather common on salty soils. A shrub up to 4 m. high, with a stem up to 15 cm. in diameter. The leaves are long and flat on both sides. Inflorescence long.

Suaeda vermiculata Forsk. — Boiss. Fl. Or. 4: 940.

PALESTINE: Env. of Aqaba (1936 *EFZ*).

Suaeda palaestina Eig et Zohary sp. nov. Fig. 1.

Fruticosa, 20—60 cm. alta, valde intricata, divaricato-ramosa, dumos semiglobosos formans; folia sessilia, subdistantia, virido-glauca, lineari-semiteretia, subarcuata, 7—12 mm. longa et 2 mm. lata, summa diminuta, sub-apiculata, floralibus conformia; bracteae binae, lanceolatae, scariosae, perigonio quadruplo breviores; flores hermaphroditi, axillares, solitarii, sessiles, tota longitudine ramorum juvenium dispositi; perigonium quinque- (raro quadri-) fidum, 5 mm. amplum; lobi ovato-oblongi, 2 mm. longi, anguste albo-marginati, apice cucullati; stamina perigonio sublongiora, anthera ovata, 1½ mm. longa, albo-lutea; ovarium pyriforme, stylus trifidus.

PALESTINE: LJ: Env. of Kallia, alluvial saline soil (1937 *E*).

One of the most common halophytic shrubs of the Lower Jordan Valley. As far as known endemic in Palestine, but may occur also in Iraq. A glaucous many branched dwarf shrub, easily distinguishable by its semi-cylindrical leaves, flat at the upper and rounded at lower face.

It is the leading species of the *Suaedetum palaestinae* which occupies large tracts in the Saharo-Sindian part of the Jordan Valley.

Suaeda mesopotamica Eig sp. nov. Fig. 2.

Fruticulosa, valde intricato-divaricata, pruinoso-hirta; folia sessilia, glauca, lineari-semiteretia, crassa, obtusa, inferiora suberecta, floralia subarcuata, 5—15 mm. logna et maximum 3 mm. lata in axillis breviter villosa; bracteae binae vel una, oblongae, scariosae, perigonio dimidio breviores; flores hermaphroditi axillares, 3 fertiles et saepe 1—2 abortivi, spicas simplices vel paulo compositas subdensas formantes; perigonium 5-fidum, 2—3 mm. amplum; lobi crassi, ovato-oblongi, naviculares, uninervi 3/4—1 mm. longi; stamina perigonio breviora, anthera lato-ovata, 1/2 mm. longa; ovarium ovatum, ad apicem constrictum; stigmata 4; fructus ignotus.

IRAQ: 130 km W of Rutbah, plain (1933 *E*).

The nearest species are *S. palaestina* and *S. vermiculata*. It is distinshed from the former by its hairy branches, by the somewhat villous leaf axils bearing 3 flowers, by the much smaller flower, the 4 stigmas, etc. It is distinguished from the latter by the shape of the leaves, the four stigmas and the number of flowers.

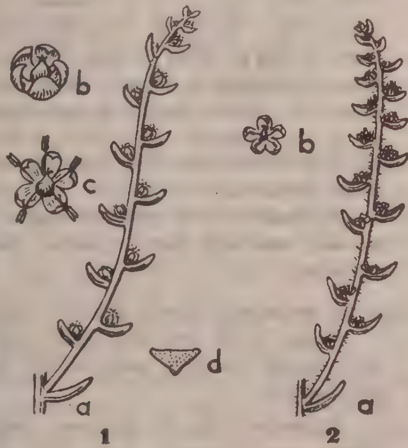

Fig. 1. *Suaeda palaestina* Eig et Zohary sp. nov.
a — flowering branch ($\times 2/_3$). b — perigonium with pistill ($\times 2$). c — open flower ($\times 2$). d — cross-section of leaf ($\times 4$).

Fig. 2. *Suaeda mesopotamica* Eig sp. nov.
a — flowering branch ($\times 4/_3$). b — flower ($\times 2\,2/_3$).

Suaeda splendens (Pourr.) Gren. et Godr. — Fl. France 3: 30.

PALESTINE: S: Saline places, Atlith (1926 *EZ*); Kabbara (1925 *EZ*).

Schanginia baccata (Forsk.) Moq. — Boiss. Fl. Or. 4:944.

PALESTINE: CN: El Arish (1925 *EZ*); JD: 22 km. E of Jerusalem (1935 *EZ Grizi*); LJ: Northern shore of the Dead Sea; Jedeida (1926 *EZ*); Ein Gedi (1926 *EFZ*). IRAQ: S. Iraq: 350 km. SE of Baghdad; 10 km. N of Amara (1933 *EZ*).

Schanginia hortensis (Forsk.) Moq. — Boiss. Fl. Or. 4: 945.

PALESTINE: AP: Haifa (1929 *Dinsmore*).

Traganum nudatum Del. — Boiss. Fl. Or. 4: 946.

PALESTINE: FN: 28 km. S of el Kusseima (1936 *EFZ*); LJ: Dead Sea, Lissan (1925 Z); AR: Env. of Aqaba (1936 *EFZ*); DA: Zerka (1933 *EFZ*); E: El Hama (1936 *EFZ*). SYRIA: Syrian Desert: Wadi Ridjal (1933 *EFZ*).

Haloxylon persicum Bge.[1] — Flora URSS, 6:311 (1936).

Palestine: E: Wadi Ithm (1936 *EFZ*).

Haloxylon salicornicum (Moq) Bge. — Boiss. Fl. Or. 4: 949.

Palestine: FN: Env. of Aqaba (1936 *EFZ*); LJ: Betw. Wadi Mouhawit and Jebel Usdum (1929 *Gabrielith*); E: 6 km. S of el Quweira (1936 *EFZ*) [2]. S. Iraq: Betw. At-Tuba and Amukhaila (1933 *EZ*); 46 km. W of Basra (1933 *EZ*); 50 km. W of Jaliba, S of Ur station (1933 *EZ*).

The material from Iraq seems to represent the typical form of this species while the material from Moab differs markedly from it. *H. salicornicum* is very abundant in Edom and in Southern Iraq and constitutes a leading species of *Haloxylonetum salicornici* on sandy soils.

Haloxylon articulatum (Cav.) Bge. — Boiss. Fl. Or. 4: 949.

Palestine: CN: El Arish (1925 *EZ*); NN: Asluj (1935 *Dinsmore*); FN: 28 km. S of el Kussaima (1936 *EFZ*); LJ: Arnon River (1936 *EF Grizi*); DA: 20 km. E of Amman (1927 *EFZ*); DG: Khirbeth Tmeiri (1927 *EFZ*); M: 6 km. S of Ziza (1936 *EFZ*), betw. Ziza and Qutrani (1936 *EFZ*); E: Wadi el Hasa (1935 *Dinsmore*). Syria: Betw. El Kaa and Zera (Karyatayn to Homs) (1932 *EZ*); 115 km. SW of Deir ez Zor (1933 *EZ*); Syrian Desert: 66 and 315 km. E of Damascus (1933 *EZ*); 120 km. E of Damascus (1933 *EZ*), 22 km. W of Sukhne (1933 *EZ*); 145 km. S of Homs (1933 *EZ*). Iraq: 53 km. W of Balad-Sindjar (1933 *EZ*); Wadi Muhammadi (1933 *EZ*).

In Southern Palestine this plant is very abundant on arable steppe soil and constitutes there a leading species of the segetal *Haloxylonetum articulati*.

Haloxylon articulatum (Cav.) Bge. ssp. *ramosissimum* (Boiss.) Eig comb. nov.

Planta 50—60 cm. alta; rami longi ascendentes; inflorescentia saepe multo longior et densior quam in typo; perigonii alae maiores, eis duo trebus aliis maiores.

Palestine: M: El Quatrani (1926 *E*). Syria: Env. of Soura el Kebire, near Damascus (1932 *EZ*). Iraq: Eastern part of the Syrian Desert (1933 *EFZ*); Tazirah near Haditha (1932 *Guest*, intermediate between *H. articulatum* and *H. articulatum* ssp. *ramosissimum*).

This form was first designated by Boissier in Herb. Boiss. as *Anabasis ramosissima* Boiss. sp. nov. (No. 1622). Another specimen (No. 2199) of the same Herbarium, probably named first *A. ramosissima* by Boissier, has been examined by Bentham and Hooker (1883), who mention this specimen in their Flora (Vol. III, p. 70) under *Haloxylon*. Thus the correct name is *Haloxylon ramnosissimum* (Boiss.) Benth. et Hook. Later,

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[1] From the editors:

For lack of fruiting specimens, original description and material for comparison the author has not been able to identify this species. Being in possession of additional material collected in Wadi Arabah in 1942 and of authentic specimens, the editors have been able to identify this species as *H. persicum*.

[2] Also NN: Qurnub (1942 Z).

however, as already remarked by HANDEL-MAZZETTI (1910), BOISSIER himself mentioned this specimen (No. 2199) in his Flora under *Haloxylon articulatum*. DINGLER (1872) collected this plant and named it *Anabasis ramosissima*. Similarly OPPENHEIMER (Florula Transjordanica p. 166) published this plant under *A. ramosissima*.

Salsola Soda L. — Boiss. Fl. Or. 4: 953.

PALESTINE: AP: Env. of Acre (1921 *E Faktorovsky*), S: Kabbara (1927 *E*).

Salsola Kali L. — Boiss. Fl. Or. 4:954.

PALESTINE: S: Env. of Hedera (1937 *EFZ*); CS: Tel-Aviv (1929 *E*). TURKEY: Taurus Mountain, Bozanti (1931 *EZ*); Amanus Mts. descent from Bakladja to Karagouz (1932 *Delbes*).

Salsola Kali L. var. *crassa* Eig var. nov.

Omnes partes crassiores; folia approximata; inflorescentia densissima, fructus apterus.

PALESTINE: AP: Betw. Haifa and Acre (1924 *E*).

Salsola Autrani Post — Post Fl. Syr. Pal. Sin. II Ed., 2: 448.

IRAQ: Syrian Desert: 130 km. W of Rutbah (1933 *E*), 70 km. W of Rutbah (1933 *EFZ*); 4 km. E of Kirkuk (1933 *EFZ*).

Salsola Autrani Post var. *hierochuntica* (Bornm.) Eig (=*S. hierochuntica* Bornm. — Beih. Bot. Centralbl. 29: 13).

PALESTINE: J: Jerusalem (1936 *F*); JD: Wadi Fara (1934 *EFZ*); NN: Beersheba (1934 *EFZ*); LJ: Jericho (1924 *Z*). SYRIA: Coelesyrian Plain: 9 km. SE of Hermel (1934 *Bot. Dept.*), Imtale near Damascus (1932 *EZ*); Syrian Desert: Wadi Radjil (1933 *EFZ*).

According to BORNMUELLER (1912) *S. hierochuntica* is very near to and perhaps identical with *S. Autrani*. This is however, not obvious from the descriptions of the two species. — The leaves in *S. hierochuntica* may reach a length of 5 cm. (and not 8—15 mm. as given in the description). In its indumentum *S. hierochuntica* shows great variability — from glabrous to densely hairy.

Salsola Volkensii Asch. et Schw. — Muschler, Man. Fl. Egypt: 296 (1912).

PALESTINE: LJ: Banks of Arnon River (1926 *EFZ*); M: 20 km. S of Qutrani (1936 *EFZ*); DA: env. of Kasr el Azrak (1933 *EFZ*). SYRIA: Syrian Desert: Betw. Wadi Sirhan and Rutbah (1933 *EFZ*), Wadi Radjil (1933 *EFZ*).

Salsola inermis Forsk. — Boiss. Fl. Or. 4: 955.

PALESTINE: JD: 12 km. E of Jerusalem (1929 *Z*); NN: Betw. Tel-Arad and Ras um Radiyeh (1934 *EFZ*); Ras Zuweira (1934 *EFZ*); FN: Ein Qadrat (1929 *EZ*); LJ: Banks of Arnon River (1926); DA: env. of Kasr el Azrak (1933 *EFZ*). SYRIA: Betw. Soura el Kbire and Heidjane, near Damascus (1932 *EZ*); 5 km. N of Karyatayn (1932 *EZ*); Syrian Desert: Jebel el Et Tanf, 270 km. E of Damascus (1933 *EFZ*). S. IRAQ: 13 km. E of Ali Gharbi (1933 *EZ*).

Salsola jordanicola Eig sp. nov. Fig. 3.

Annua 15—30 *cm. alta, papilloso-farinosa et pilis longis* ± *patule villosa; parte inferiore demum subglabra; caules tenues, albidi, regulariter ramosi, ramis ascendentibus; folia alterna, laxa, cito decidua, ad basim dilatata, linearia, obtusa,* 1—2 *cm. longa, dense papillosa, farinosa et villosa; folia floralia valde diminuta, triangularia, bracteas non superantia; bracteae amplae demum accrescentes et saepe persistentes, orbiculate, albo-marginatae; perigonii phylla late ovata, cucullata, apiculata,* 2½ *mm. longa et* 3—4 *mm. lata; phylla fructifera, farinosa; alae versus perigonii medium insertae, explanatae, albo-fuscae, una* 4—5 *mm. longa; ovarium depresso-globosum, stylus ovario duplo brevior; stigmata* 2, *brevissima, inaequalia; stamina* 5, *pistilli filamentis aequales, antherae brevissimo-appendiculatae.*

Fig. 3. *Salsola jordanicola* Eig sp. nov.
a — flowering branch (×2/3). b — pistill (×2). c — perigonium (×2). d — leaf (×4/3). e — bracteoles (×4/3).

Fig. 4. *Salsola Postii* Eig sp. nov.
a — flowering branch (×2/3). b — pistill (×2 2/3). c — flower (×2 2/3) d — flower cluster (×2 2/3).

PALESTINE: JD: Wadi Kelt (1928 *Gabrielith*); LJ: Kallirhoe (1925 *EZ*). SYRIA: Syrian Desert, 120 km. E of Damascus (1933 *EZ*). IRAQ: 130 km W of Rutbah, plain (1933 *EZ*).

The nearest species are *Salsola inermis* on one hand, and *Salsola Volkensii* on the other, both occurring also in the Lower Jordan Valley. It is distinguished from either by the larger flower, the much more persistent bracts. From *S. Volkensii* it is further distinguished by its hairiness and from *S. inermis* by the longer wings of the fruiting perigonium, the longer and looser leaves, etc.

Salsola tetrandra Forsk. — Boiss. Fl. Or. 4:957.

PALESTINE: JD: 24 km. E of Jerusalem (1935 *EFZ*); FN: Betw. Kuntilla and el Kussaima (1936 *EF*); LJ: Near the Allenby Bridge (1935 *E Grizi*); A: Betw. Amman and Azrak (1927 *EFZ*); M: 20 km. S of el Qutrani (1936 *EFZ*); E: 10 km. S of Qala'at-el-Hasa (1936 *EFZ*). SYRIA: 10 km. E of Salemiye (1933 *EZ*).

BOISSIER mentions the fact that no fruit were found in this species. We too did not find in any of our specimens any winged fruit; does this species develop wings at all? Our specimens have tetramerous flowers and according to the differential characters given by BOISSIER belong, therefore to *S. tetrandra* and not to *S. tetragona*. To the description of this species we may add the following details: 2 leaves of the perigonium are twice as broad as the other two, while the broader leaves possess 1—2 nerves and a green prominent portion, the other two are altogether hyaline.

Salsola Postii Eig sp. nov. Fig. 4.

Fruticulosa; caules erecti, albi, glabri, in foliorum et bractearum axillis dense villosi; folia alterna, crassa, 1—2 cm. longa, obtusa, glabra; flosculi in glomerulos (3—5 *floros*) *densos dispositi, spicas subdensas formantes; bracteae nonnullae, una folio similis, sed minor ad basin concavo-dilatata, caeterae ovato-concavae, omnes ad basin membranaceae; bracteolae binae; perigonii phylla ad basin paulo coalita, hyalina, oblonga,* 2½—3 *mm. longa, dorso ad medium vel supra gibba* (*alae futurae?*); *staminodia quina, semiorbiculata, ciliata, in discum staminiferum prominentem* (*perigonio dimidio longiorem*) *coalita; stamina quina; antherae oblongae, muticae,* 1 *mm. longae; ovarium oblongo-pyriforme; stylus brevissimus vel nullus; stigmata bina, clavato-lanceolata, subrecurva.*

SYRIA: Deir Attiye to Karyatayn and el Jebah to el Beida (both 1890 *Post* under *S. glauca* M. B.).

We have also seen a third plant under the name of *S. glauca* (recorded in POST 1932) but this is *Hypocylix Kerneri* mentioned above.

Salsola glauca proper does not occur in Syria. If we follow BOISSIER strictly (Flora Orientalis Vol. 4), BENTHAM et HOOKER (Genera Plantarum), VOLKENS (Pflanzenfamilien) etc. this species should be considered a separate genus. By its floral characters our species approaches *Seidlitzia* most nearly. But the species of this genus possess opposite leaves and to a certain extent jointed branches and thus they are easily distinguished from our species. The position of the genus *Seidlitzia* is very doubtful. The generic differences of *Salsola*, *Seidlitzia* and *Haloxylon* (= *Arthrophyton* after LITWINOV) after VOLKENS are as follows: *Haloxylon* is distinguished from *Seidlitzia* and *Salsola* by the jointed branches; *Salsola* from *Seidlitzia* by the equal wings of the fruiting perigonium and by the absence of the staminodia and of the staminodial ring, which in *Salsola*, if present, is a very stout one. BOISSIER on the contrary attributes to *Seidlitzia* jointed branches and assumes it to be very near *Haloxylon*. *Salsola*, on the contrary, is well distinguished from both *Seidlitzia* and *Haloxylon* by the non-jointed branches, by the absence of the staminodia and by the non-monadelphous stamens. From the point of view of BOISSIER our plant is neither *Salsola* nor *Seidlitzia*. Yet SOLMS-LAUBACH (1901) united *Seidlitzia* with

Salsola, as according to him the interstaminal ring is found also in the true *Salsola*; he also could not confirm the assumed differences in the wings between *Seidlitzia* and *Salsola*. I agree completely with SOLMS-LAUBACH on this last point. I did not particularly examine the plant to ascertain whether a staminodial ring is present in any *Salsola* species. But in our species this ring is well developed. I rely upon SOLMS-LAUBACH that he found the ring in some other species of *Salsola*, and thus it seems to me that our species as well as the *Seidlitzia* species mentioned below can be included in the genus *Salsola*. The genus *Salsola*, widened in this manner, closely approaches *Haloxylon* (*Arthrophyton*); the only difference is in the jointed branches. *Salsola* (*Seidlitzia*) *Rosmarinus* with its nearly jointed branches is a species which connects the both genera.

It is a pity that in the specimens of our new species no fruits were found so that its systematic position remains somewhat doubtful.

Salsola (*Seidlitzia*) *Rosmarinus* (Ehr.) Solms-Laub. — Bot. Ztg. 9:171 (1901).

PALESTINE: NN: Zuweira (1892 *Post*); LJ: Betw. Jericho and Allenby Bridge (1935 *EZ Grizi*); AR: Env. of Aqaba (1936 *EFZ*); E: 15 km. S. of Qala'at-el Hasa (1936 *EFZ*). SYRIA: Syrian Desert: Wadi Ridjal (1933 *EFZ*).

Salsola lancifolia Boiss. — Boiss. Fl. Or. 4:958.

PALESTINE: JD: Wadi Kelt (1932 *EF*); NN: Beersheba to Madsus (1934 *EFZ*); LJ: Ein Gedi (1926 *EFZ*); DA: el Muakkar to el Kharani (1927 *EFZ*); E: 9 km. N of Aneze (1936 *EFZ*). SYRIA: Syrian Desert: Wadi Sirhan to Rutbah (1933 *EFZ*); 10 km. N. of Karyatayn (1932 *EZ*). IRAQ: Syrian Desert: 360 km. E of Damascus (1933 *EZ*).

Salsola foetida Del. — Boiss.Fl.Or. 4: 961.

PALESTINE: LJ: Dead Sea, Lissan (1936 *EFZ*).

Rather rare in Palestine.

Salsola Schweinfurthii Solms-Laub. app. Eig.

Fruticosa, 15-30 cm. alta, e basi valde ramosa; caules ascendentes, glabri, albi, paulo ramosi, rami inferiores, saepe oppositi, caeteri, alterni; folia inferiora saepe opposita, caetera alterna, lineari-subcylindrica, carnosa, arcuata, 10—30 mm. longa; axillae ± lanigerae; folia floralia valde diminuta, cucullata, bracteolas suborbiculatas concavas superantia; flores solitarii vel saepe terni, spicas sublaxas formantes; perigonii phylla quina, lato-ovata, suborbiculata, subcucullata, late albo-marginata; staminodia quina, brevissima, glabra in discum staminiferum coalita; stamina quina, antherae ovato-oblongae; ovarium ovatum, superne angustatum, in 2 stigmata brevia et crassa abeuns; perigonium fructiferum alis orbiculatis, subaequalibus et horizontalibus praeditum.

PALESTINE: JD: Wadi Ghar (1934 *EFZ*): NN: Kurnub (1934 *EFZ*); FN: 30 km. NW of el Kuntilla (1936 *EFZ*); LJ: Dead Sea, Lisan (1925 *EZ*).

Salsola vermiculata L. ssp. *villosa* (Del.) Eig (= *S. villosa* Del.). — Boiss. Fl. Or. 4:962.

PALESTINE: JD: 20 km. E of Jerusalem (1934 *EFZ*); NN: Beersheba to Madsus (1934 *FZ*); LJ: Wadi Nimrin 12 km. E of Allenby

Bridge (1929 *EF*); DA: el Muakkar to el Kharani (1927 *EFZ*); M: 20 km. S of Ziza (1936 *EFZ*); E: 9 km. N of Aneze (1936 *EFZ*). SYRIA: 30 km. S of Homs (1933 *EZ*); ca. Damascus (1931 Z); 60 km. SW of Hussetché (1933 *EZ*); Coelesyrian Plain: 9 km. S of Hermel (1934 *Bot. Dept.*); 78 km. W of Soukhne (1933 *EZ*); Nebk (1931 Z); 135 km. E of Damascus (1933 *EZ*). IRAQ: Syrian Desert: 515 km. E of Damascus (1933 *EZ*); 480 km. E of Damascus (1933 *EZ*); 130 km. W of Rutbah Plain (1933 *E*); 50 km. W of Balad Sindjar (1933 *EZ*); 80 km. NE of Deltawah (N of Baghdad) (1933 *EZ*); Jebel Hamrin (1933 *EZ*).

Salsola villosa was first mentioned by DELILE (1824) in the enumeration of plants growing in Egypt. MOQUIN recorded this species first (1840) in the Chenopodearum monographica enumeratio and later (1849) in DC. Prodromus XIII, p. 181. While MOQUIN considered *S. villosa* a variety of *S. vermiculata* L., BOISSIER (1879) classed it as a variety of *S. rigida* Pall. and named it var. *tenuifolia* Boiss. It is true that BOISSIER had his doubts whether the plants of Palestine, Syria and Iraq had to be referred to *S. villosa*. BOISSIER had not seen this plant from Egypt and this was probably the reason why he changed the name of the variety.

ASCHERSON and SCHWEINFURTH (Ill. Fl. d'Egypt 1887) recorded both species *S. rigida* and *S. vermiculata* var. *villosa*, for Egypt while MUSCHLER (1912) and RAMIS (1929) mention only *S. vermiculata* var. *villosa*. POST follows BOISSIER in this regard.

In fact, there is no difficulty in distinguishing our species from *S. rigida* (by smaller wings, thick and fleshy leaves, etc.). On the other hand, our species is much nearer to *S. vermiculata*, differing from it mainly by the denser and longer indumentum, the longer leaves (especially the younger ones), the generally larger wings of the perigonium, by its whitish canescent hair, fleshy bracts with more whitish indumentum, etc. In our opinion, therefore, the plant should be tentatively named *S. vermiculata* L. ssp. *villosa* (Del.) Eig, and this has also its ecological reasons: While *S. rigida* is an Irano-Turanian species, *S. villosa* is a Middle-Saharo-Sindian and *S. vermiculata* an Irano-Turanian species strongly inclining to Mediterranean conditions.

Salsola canescens (Moq.) Boiss. — Boiss. Fl. Or. 4: 963.

BOISSIER recorded this plant from Jebel Makmel (Lebanon). POST (1896) mentioned the same locality, while DINSMORE (in POST 1932) recorded this plant also from Jabah to el Bayda (Syrian Desert, det. POST).

I have examined the specimen of Jabah and identified it as a non-typical form of *S. vermiculata* ssp. *villosa*. It is thus doubtful if this species occurs even in Syria, although I have not seen the specimens of Jebel Makmel. In Palestine this species certainly does not occur.

Noea mucronata (Forsk.) Asch. et Schw. (= *N. spinosissima* L.) — Ill. Fl. d'Egypte: 131 (1887).

PALESTINE: CN: El Arish (1925 *EZ*); J: Jerusalem (1933 *Amdursky*); JD: 16 km. E of Jerusalem (1934 *EFZ*); NN: 3 km. S of Beersheba (1935 *EFZ*); FN: 10 km. S of el Kusseima (1936 *EFZ*);

LJ: Near the Allenby Bridge (1932 *EZ*); A: Amman (1926 *E*); DA: 7 km. E of Amman (1933 *EFZ*); M: Belka, Jebel es Suwaka (1936 *EFZ*); E: El Hesma, 24 km. N of el Queira, (1936 *EFZ*). Syria: 145 km. and 107 km. S of Homs (1933 *EZ*); Homs (1932 *EZ*); 17 km. W of Hussetche (1933 *EZ*); Coelesyrian Plain: 9 km. SE of Hermel (1934 *Bot. Dept.*); NE Syria: 116 km. SW of Deir ez Zor (1933 *EZ*). Iraq: 3 km. N of Balad Sindjar (1933 *EZ*); 80 km. NE of Deltawah (N of Baghdad) (1933 *EZ*); Jabal Hamrin (1933 *EZ*). S. Turkey: Betw. Bozanti and the Al Kopru bridge (1931 *EZ*).

In Palestine, the Syrian Desert and Iraq it is a typical steppe plant. in Palestine, especially in the Judean Desert it constitutes the leading species of the Irano-Turanian *Noeetum mucronatae*.

Noea mucronata (Forsk.) Asch. et Schw. var. *humilis* (Boiss.) Eig (=*N. spinosissima* L. var. *humilis* Boiss.) — Boiss. Fl. Or. 4: 965.

Syria: N Lebanon: Ascent Qarnet et Souda (1931 *EZ*); Jebel Matrafeh (1934 *Dept. Bot.*); Karnita to Ain el-Barkawiyeh (1934 *Bot. Dept.*); Bakafra to Bsherra (1931 Z); Ehden to Talieh (1931 *EZ*); Mt. Hermon, Shiba to Ain Zbib (1929 *Gabrielith*); Ain Jine (1924 E); Rashaye (1924 E).

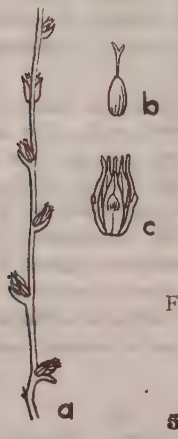

Fig. 5. *Noea kurdica* Eig sp. nov.
a — flowering branch ($\times 2/3$).
b — pistill ($\times 2$). c — flower ($\times 2$).

Noea kurdica Eig sp. nov. Fig. 5.

Suffrutex 30—40 cm. alta, tota ± dense scabro puberula; rami erecti, elongati, simplices et paulo ramulosi, praeter partem inferiorem omnes pungentes, tota longitudine florigeri; folia pauca infima opposita, caetera alterna, glauca, erecta, patenti-erecta vel patenti-recurva, lineari filiformia, infima 20—25 cm. longa, caetera gradatim breviora cito decidue; folia floralia bracteis conformia, eis subaequalia; bracteae floribus aequales vel breviores, lanceolatae, naviculares, dorso carinatae, praeter marginem membranaceum album, virides, floribus adpressae; flores solitarii, laxi; perigonium pentaphyllum, persistens, phylla inter se subaequalia, subconcava, oblongo-lanceolata, cuspidato-acuminata, tota albo-membranacea, obscure 3-5-nervia, 6—7 mm. longa, ad medium gibba; alae (valde juvenales) mem-

branaceae, ovato-oblongae; nectarium cupuliforme, crenatum; stamina sub nectario inserta; filamenta linearia, sepalis multo breviora; ovarium ovale, stylus filiformis, longus; stigmata duo, inaequilonga.

IRAQ: Iraqian Kurdistan: Qara-Dagh NE of Kanitacht; Suleimani District: Pir i Mukurun Dagh (1933 *EZ Duvdevani*).

Anabasis Haussknechtii Bge. — Boiss. Fl. Or. 4:969.

PALESTINE: NN: Beersheba to Tel-Milh (1927 *EFZ*); FN: Shayta (1935 *Dinsmore*); M: Mashitta (1928 *Dinsmore*), El Qutrani (1926 *E*); E: Ma'an (1936 *Dinsmore*). SYRIA: Betw. Adrah and Dumeir (1889 *Post*).

The characteristic given by BOISSIER for this species "folia setifera" is not specific since it occurs also in the most specimens of *A. articulata*. In the specimen of POST from Adra to Dumeir there is a 3-winged perigonium as in the authentic specimen of BUNGE. But is this characteristic (3 winged perigonium) sufficient to distinguish this species from *A. articulata?* At all events *A. Haussknechtii* is nearer to *A. articulata* than to *A. aphylla*.

While *A. Haussknechtii* is a Saharo-Sindian plant *A. aphylla* is Irano-Turanian. BOISSIER does not mention it in his Flora.[1]

Anabasis articulata (Forsk.) Moq. — Boiss. Fl. Or. 4: 970.

PALESTINE: CN: El Arish (1925 *EZ*); JD: Wadi Kelt (1931 *EFZ*); NN: Beersheba to Madsus (1934 *EFZ*); FN: Ain Qadrat (1929 *E*); LJ: Ein Gedi (1931 *E*); A: 22 km. E of Amman (1927 *EFZ*); DA: El Muakkar to el Kharani (1927 *EFZ*); M: 3 km. S of Ziza (1936 *EFZ*); E: 8 km. S of Aneze (1936 *EFZ*). SYRIA: 130 km. S of Homs (1933 *EZ*); 75 km. S of Homs (1933 *EZ*); Env. of Chulehul (1932 *EZ*); Syrian Desert: Env. of Adra, W of Dumeir, near Damascus (1933 *EZ*), 34 km. SW of Damascus (1933 *EZ*), near Hama (1932 *Uvarov*), betw. Wadi Sirhan and Rutba (1933 *EFZ*), Karyatayn (1930 Z) 490 km. E of Damascus (1933 *EZ*), 50 km. E of Damascus (1933 *EZ*), above Jebel El-Kara, near Damascus (1932 *EZ*). IRAQ: 27 km. W of Ramadi (1933 *EF*).

One of the most common desert plants, characteristic of the Hammadas. It is the leading species of the *Anabasidetum articulatae*, very common in the Negev, Transjordan, Syrian Desert and Sinai.

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[1] From the editors:

Examination of the abundant material collected in 1942 in Negev and Transjordan as well as direct observation of the plants in their natural habitats proved that *A. Haussknechtii* Bge. is a well defined species, which, apart from its 3-winged perigonium, differs from *A. articulata* by different habit and habitat.

A. Haussknechtii produces in spring long erect shoots which dry up after fructification. The lignified parts of the plant are usually only about 10 cm. high. It is usually found on cultivated steppe soil in the Irano-Turanian parts of the country, whereas *A. articulata* grows on the stony Hammada.

Anabasis setifera Moq. — Boiss. Fl. Or. 4: 970.

PALESTINE: JD: Env. of Wadi Kelt (1934 *Boznier*); LJ: Dead Sea near the Arnon River (1936 *EF Grizi*); Ein Gedi (1926 *EFZ*). IRAQ: S. Iraq: Env. of Jaliba (1933 *EZ*), 76 km. W of Basra (1933 *EZ*).

Anabasis annua Bge. — Boiss. Fl. Or. 4: 971.

IRAQ: 70 km. W of Rutbah (1933 *EFZ*).

Halocharis sulphurea Moq. — Boiss. Fl. Or. 4: 975.

IRAQ: Env. of Tuz (1930 *Guest*).

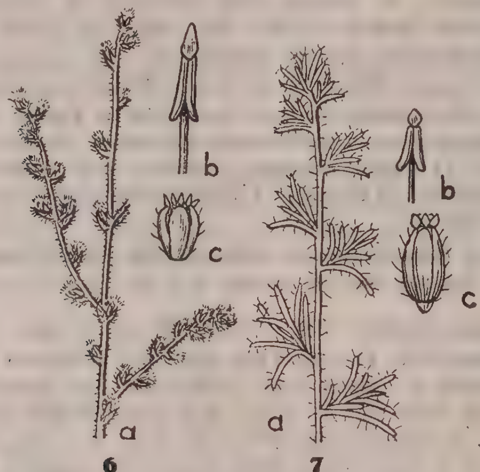


Fig. 6. *Halocharis syriaca* Eig sp. nov.
a — flowering branch ($\times 2/_3$). b — stamen ($\times 4\ 2/_3$). c — flower ($\times 2\ 2/_3$).

Fig. 7. *Halocharis brachyura* Eig sp. nov.
a — flowering branch ($\times 2/_3$). b — stamen ($\times 2\ 2/_3$). c — flower ($\times 2\ 2/_3$).

Halocharis syriaca Eig sp. nov. Fig. 6.

Annua, e basi ramosa; folia inferiora? (non vidi), superiora carnosula, 1- 14 mm. longa, lineari-oblonga, semicylindrica, usque subtrigona, e basi membranaceo-dilatata, obtusa, ± dense longo-pilosa, bracteolis latiora et sublongiora; bracteae lineari-triquetrae, carnosae, denso-villosae, flosculis denso-capitatis aequilongae; perigonii phylla hyalina, apice rotundata, ca. 3 mm. longa, eorum duo oblongo-spathulata, densissime hirsuta, caetera latiora, spathulata, (glabra?); filamenta brevia, demum non elongata, phyllis aequilonga; anthera cum appendice 3 mm. longa; antherarum appendix sulphurea, lanceolata, subapiculata, sessilis, loculis aequilata et eis dimidio brevior; stigmata subrecurva.

SYRIA: Syrian Desert: El Beida to Palmyra (1890 *Post*).

The nearest species are *H. hispida* C. A. M. and *H. sulphurea* Moq. *H. syriaca* has anthers of *H. hispida* and spikes of *H. sulphurea*. It seems to be nearer the former than the latter. Described from an incomplete specimen and needs further study.

Halocharis brachyura Eig sp. nov. Fig. 7.

Annua, humilis e colo ramosa, pilis basi tuberculatis hispidissima; folia carnosula, linearia, semicylindrica, e basi membranaceo-dilatata, infima 3—5 cm. longa, caetera 1—2 cm. longa, omnia sparse longo pilosa; folia floralia in planta juveni bracteolis conspicue longiora; bracteae in planta juveni foliis floraliis similes sed minores; flores capitato-spicati, inferiores subdistantes, superiores densiores; perigonii phyllo hyalina, apice rotundata, 4 mm. longa, binis externis oblongis, longe et sparsim villosis, caeteris obovato-spathulatis, glabris; filamenta perigonio dimidio breviora, ca. 2 mm. longa, demum valde elongata et perigonio longiore; antherae filamentis longiores; antherarum appendix sulphurea, ovata, sessilis, loculis aequilata et eis triplo-quadruplo brevior; stylum phyllis sublongior; stigmata duo recurva.

IRAQ: Near the banks of Chankula River (1933 *EZ*); 94 km. SE of Baghdad (1933 *EZ*); 133 km. SE of Baghdad (1933 *EZ*).

By its very short ovate appendix of anthers it is readily distinguished from the other species of this genus reported in BOISSIER's Flora Orientalis. The nearest species are *H. hispida*, C.A.M., *H. sulphurea* Moq. and *H. syriaca* m. It is distinguished from the former by the size of the leaves and the shape of the floral leaves; from the second by the appendix, the looser spikes and the looser indumentum.

Halimocnemis pilosa Moq. — Boiss. Fl. Or. 4: 976.

PALESTINE: DA: El Muakkar to el Kharani (1927 *EFZ*). IRAQ: About 70 km. E of Rutbah (1933 *EFZ*).

Cornulaca Aucheri Moq. — Boiss. Fl. Or. 4: 983.

IRAQ: Mandali (1930 *Guest*); 4 km. E of Kirkuk (1933 *EFZ*).

Cornulaca setifera Moq. — Boiss. Fl. Or. 4: 984.

SYRIA: Syrian Desert: Palmyra (1930 *Z*).

Halogeton alopecuroides (Del). Moq. — Boiss. Fl. Or. 4: 985.

PALESTINE: JD: 25 km. E of Jerusalem (1934 *EFZ*); NN: Env. of Qurnub (1934 *EFZ*); FN: 28 km. S of el Kussaima (1936 *EFZ*); LJ: Jericho (1910 *Dinsmore*); DA: El Muakkar to el Kharani (1927 *EFZ*); M: Jebel es-Suwaka (1936 *EFZ*); E: 9 km. N of Aneze (1936 *EFZ*). SYRIA: About 30 km. W of Karyatayn (1932 *EZ*); Syrian Desert: 80 km. E of Damascus (1933 *EZ*); Wadi Radjil (1933 *EFZ*).

Halogeton alopecuroides (Del.) Moq. var. *papillosus* Eig var. nov.

Rami et praesertim folio dense et breve papilloso-hispidi.

PALESTINE: FN: ca. 30 km. NW of el Quntilla (1936 *EFZ*).

ECOLOGICAL INVESTIGATIONS IN PALESTINE

I. THE WATER BALANCE OF SOME MEDITERRANEAN TREES[1]

By ALEXANDRA POLJAKOFF

(With Plate IV and 6 graphs in the text)

The aim of this paper is to give an inside view of the water balance of some typical Mediterranean trees. The trees investigated by us were *Olea europaea*, *Ceratonia Siliqua* and *Amygdalus communis*. Their water balance has already been disucssed by several authors, but most of the investigations have been carried out in the northern part of the Mediterranean region (ROUSCHAL 1930; v. GUTTENBERG 1907, 1927). OPPENHEIMER (1932) alone worked in Palestine where he carried out the first ecological research, and he did not investigate a whole annual cycle.

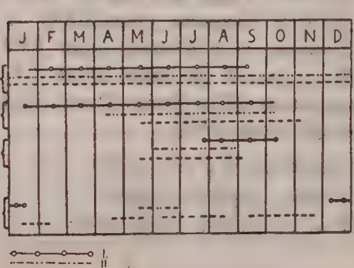
GENERAL PART

(i) *The trees and their habitat*

This study was carried out on Mt. Scopus, Jerusalem, between January and December of the year 1939. The investigated trees are situated on the grounds of the Hebrew University, on the eastern edge of Mt. Scopus facing the Judean Desert. The soil constitutes a 40—70 cm. deep, white calcareous layer overlaying a soft limestone (nari). There are also spots completely devoid of soil.

The trees were about 35-40 year old. The almond tree was 2 m. high, the olive and the carob trees had reached a height of 4-6 m.; all grew under more or less natural conditions, i. e. without cultivation or watering.

The phenological observations made on Mt. Scopus are summarized in Graph 1. The most interesting facts are: (a) *Ceratonia*



Graph 1: PHENOLOGIC SCHEME: I — *Prunus Amygdalus*, II — *Olea europaea*, III — *Ceratonia Siliqua*.
1 — the period during which the tree is green, 2 — development of new leaves, 3 — leaf abscission period, 4 — flowering.

[1] This study is part of a physiological-ecological cycle of investigations of Palestinian flora carried out by the Department of Botany of the Hebrew University under the supervision of Dr. M. EVENARI.

blossomed 4 times a year, (b) young leaves are formed during the whole summer period.

(ii) *Climate*

According to ASHBEL (1934—1939, 1937, 1945) the climate of Palestine is characterized by the following features: The year is sharply divided into a rainy and a dry season. The rainy season occurs in the mountains (Jerusalem, etc.) between November and May; the number of rainy days is 40-60 and the annual amount of rain is 500 mm on the average. The dry season comprises the months of June through October. Particularly dry climatic conditions occur on khamseen days when a hot eastern wind blows from the desert. On these days the temperature rises considerably and evaporation as well as the saturation deficit of the atmosphere increase markedly.

(iii) *The root system of the trees*

(1) *The Olive Tree* (Plate IV A).

The base of the trunk is bulblike. The main roots spread in all directions throughout the soil stratum, reaching a diameter equal to that of the branches. The branching of the roots is directed mainly towards the periphery, but the entire space between the trunk and the perimeter of the roots is filled by a dense net of very thin rootlets bearing root hairs. Few of the roots penetrate into the limestone, but not very far. Rarely does a root penetrate the limestone as much as a meter.

The length of the vertical roots depends mainly on the depth of the soil. They are in general approximately 40-45 cm. long. In the hilly districts, where the soil layer is very thin, they are 30-35 cm. long, but in the wadis they reach about 60 cm. because of the greater depth of the soil.

(2) *The Carob Tree*

The roots are mostly superficial, and longer than those of the olive tree. The radius of the zone filled by roots is 5-6 m. and its depth 15-50 cm.

We may thus say that one tree requires approximately 45 cubic meters of soil for its water supply.

(3) *The Almond Tree*

This tree is of quite a different type. It has a tap root penetrating into the limestone rock (Plate IV B). In attempting to follow the roots we reached a depth of 2 m. There the root was still 5 cm. thick. Horizontal roots of considerable length were also observed. This confirms OPPENHEIMER's (1932) report of a root depth of 4 m.

(iv) *Methods used in this work*

Transpiration: HUBER's method (1927) was used; time of exposure was 3 min. The transpiration was calculated as per fresh weight and per water content (mg/g/min); *stomatal aperture*: meas-

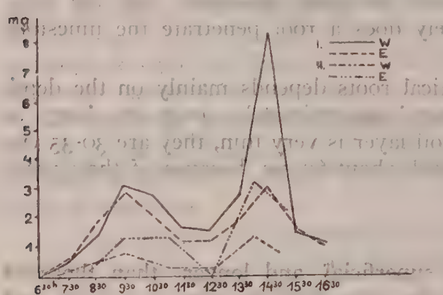
ured by infiltration with DIETRICH'S set of fluids as used by OPPENHEIMER and MENDEL (1939); *osmotic value*: measured by the cryoscopic methods described by WALTER (1931); *saturation deficit of the plant*: STOCKER'S method (1929) was used. *Evaporation*: Measured by PITCHE'S tube evaporimeter. *Relative humidity*: Wet and dry swing thermometer. *Suction pressure of the soil*: Measured by HANSEN'S method, simplified by STOCKER (1930). For *light intensity*: Relative values only were obtained by means of a Tempiphot photometer, generally used in measuring light intensity for photographic purposes.

SPECIAL PART

(i) *The daily course of the curves*

(1) *Transpiration*

The curves showing the course of transpiration are very similar in all the trees. The rate of transpiration, negligible at sunrise, increases up to a morning maximum. At 10 a.m. it starts decreasing; there is another rise towards the afternoon, after which transpiration falls, reaching zero shortly after sunset. Daily transpiration thus follows a double apex curve (Graph 2). This is typical for days without an extreme rise in temperature and saturation deficit of the air.



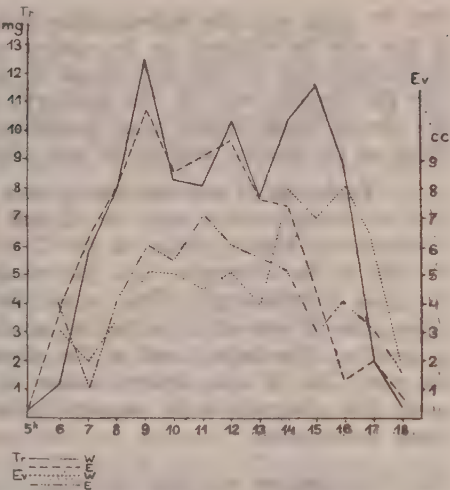
Graph 2: FRESH WEIGHT TRANSPIRATION CURVE
I — for *Ceratonia Siliqua* on 25.12.1939.
W — western side, E — eastern side, sunrise 6h35, sunset 16h15.
II — for *Olea europaea* on 24.3.1939 — rainy day.
W — western side, E — eastern side, sunrise 5h45.

On khamseen and hot summerdays the transpiration curves show more or less sizable irregularities and the transpiration usually follows a triple apex curve (Graph 3). We observed no single apex-curves for any of the trees during the whole year. Mention should be made here that ROUSCHAL (1938) in his work about the transpiration of some Maquis plants states: "Am haeufigsten erfolgt die Transpiration in Form zweigipfeliger Kurven" (p. 514).

The daily course of transpiration changes with the direction of the wind, western or eastern. Differences in the transpiration course were also noticed between leaves on the eastern and western sides of the tree.

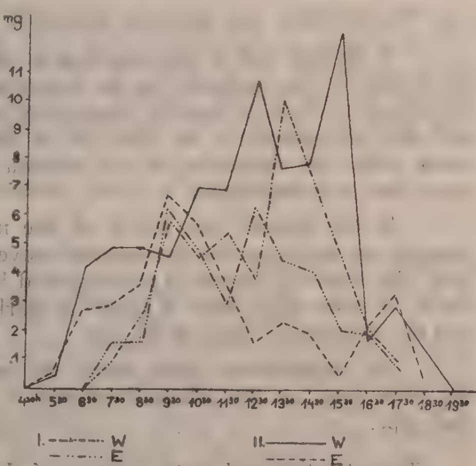
On an ordinary day with W or NW wind a definite parallelism exists between the transpiration curves on either side of the tree (Graph 2) while on days with eastern wind even when it blows for

Graph. 3: Tr. — FRESH WEIGHT TRANSPIRATION CURVE for *Prunus Amygdalus* on 2.5.1940.
Ev. — EVAPORATION CURVE for the same day measured on the two sides of the tree.
W — western side, E — eastern side, sunrise 5h00, sunset 18h00.



few hours only, this parallelism is upset. Good examples are the *Ceratonia* curves of the 25.6.1939, when a SE wind was blowing between 7.30 a.m. and 3.30 p.m. (Graph. 4) and the *Olea* curve of 11.10.1939 with a SE wind blowing between 11.00 a.m. and 2.00 p.m. (Graph 4). From these two curves it is clear that in the presence of the SE wind, while the rate of transpiration rises on the western side of the tree, it falls on the eastern side. And again when the transpiration on the western side starts to fall, it rises on the eastern side to its highest point for the given day.

Graph. 4: FRESH - WEIGHT TRANSPIRATION CURVE
I — for *Olea europaea* on 11.10.1939.
W — western side. E — eastern side, sunrise 6h00, sunset 16h35.
II — for *Ceratonia Siliqua* on 25.6.1939.
W — western side, E — eastern side, sunrise 4h35, sunset 15h15.



The highest rate of transpiration during the day varies in different plants. In *Ceratonia* the highest value for the day almost invariably occurs in the afternoon and on the western side of the

tree. In *Olea,* also, the highest value is reached in the afternoon, but it may also be obtained on the eastern side of the tree, as recorded on the 24.3.1939 (a rainy day, Graph 2), on 17.5.1939 and on 10.7.1939. For the almond tree, on the contrary, the maximal values for the day always occur before noon, sometimes on the western and sometimes on the eastern side of the tree, without any regularity.

Each side of the tree has its own maximal value for the day. (In our measurements only the E and W side were studied. For *Ceratonia* the highest values on the E side occur before noon, on the W side in the afternoon, i. e. the maxima follow the route of the sun (see Filzer 1938). This is not the case for *Olea* and *Amygdalus.* The E side of *Olea* has its maximal value before noon for 5 months (May-Sept.) and in the afternoon for the remainder of the year. The W side always reaches its highest value in the afternoon. For *Amygdalus* the maximal values on the two sides always occur before noon.

(2) *Transpiration and light intensity*

Transpiration does not depend wholly on light intensity. Comparing the rate of overcasting of the sky with the transpiration curves, we may say that there is a fall in transpiration parallel to the cloudiness. But transpiration depends only partly on light intensity as is well known and shown by our observations on cloudless days when the transpiration rises and falls several times during the day. There is, however, no doubt that the maximal values of transpiration occur when the leaves are exposed to the direct rays of the sun.

(3) *Transpiration and stomatal movement*

A marked fall in transpiration is almost always accompanied by closing of the stomata. In the leaves of the carob tree there is a tendency to close the stomata between 10.30-14.30 (April—October), and this corresponds to the first fall in the daily curve of transpiration, while the reopening of the stomata corresponds to the afternoon rise in transpiration.

In the almond tree nearly all the main fluctuations in transpiration are accompanied by stomatal movements. Occasionally, however, the stomatal closure is accompanied by only a slight fall in the curve. In such cases there is always a marked rise in the evaporation and the saturation deficit of the air.

No observations were made on the stomatal movements of the olive tree, as the adopted method is unsuitable for the hairy leaf type.

(4) *Transpiration and water content of the leaves*

In most instances a high rise in transpiration is connected with the decrease of the water content of the leaves. Sometimes, however, the water content increases with a slight rise in transpiration.

(5) *Transpiration and water saturation deficit of the plant*

The water saturation deficit was measured only three times during the day. It is therefore difficult to come to any conclusions as to its daily course. The deficit has a marked tendency, to rise towards midday, especially in the olive and the carob trees. Sometimes the high deficit persists till the evening hours, or even reaches its maximum in the evening shortly before sunset. This occurs mainly on days of a prevailing SE wind.

(6) *Cuticular transpiration*

On 27.8.1939, 14.12.1939 and 25.12.1939 we made some observations on the cuticular transpiration of our trees. The lower side of representative leaves was covered with vaseline and the time of exposure varied from 3 to 10 min. For *Olea* and *Ceratonia* the cuticular transpiration was so slight that it could not be measured by the method used. For *Amygdalus* we observed values of about 1.13 mg/g. min (measured on 27.8.1939 at 12.30). The stomatal transpiration measured at the same time was about 20-30 times greater.

(7) *Transpiration at night*

An experiment in measuring transpiration at night was made on 22./23.8.1939, a typical summer night (t^0=18-20°C during the night; minimum 17°C, maximum 21°C; relative humidity 91-100%). There was no transpiration during the night. Our trees were transpiring only for ½ - 2 hours after sunset at a very low rate, i. e. 0,5 - 1,0 mg/g. min.

(8) *Transpiration during rain*

The transpiration of olive and almond tree was measured during rain. It was negligible. When the rain ceased the transpiration of the almond rose immediately to 6 mg/g. min in spite of the fact that the evaporation rate and saturation deficit of the air were very low.

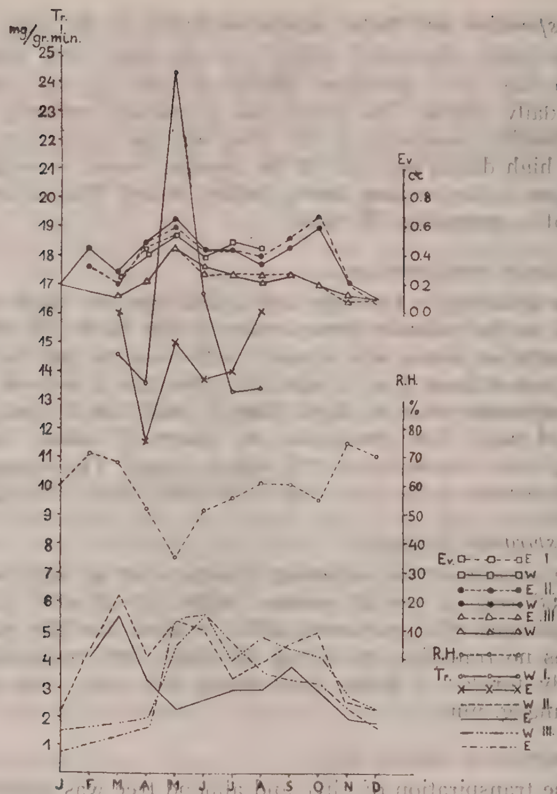
(ii) *The annual course of the curves*

(1) *Transpiration*

The curves of the three plants are double apex curves (Graph 5 and Table 1). The first apex was obtained during the period of March - June, the second during August - October.

During the period of November - January the transpiration of *Olea* and *Ceratonia* is very low (*Amygdalus* is leafless during these months). The rise starts in April and reaches its maximum in May-June for all the three trees. There is a fall in July, then a second rise of the curve forming the second apex for August - October.

The transpiration of *Ceratonia* and *Olea* is more or less on the same level. The transpiration rate of the almond is extremely high in comparison with that of the other two trees (Table 1). It is very high on an absolute scale, as shown by the high maximal



Graph. 5. ANNUAL COURSE OF EVAPORATION, RELATIVE HUMIDITY AND TRANSPIRATION

Ev. — Evaporation; R. H. — Relative humidity; Tr. — Transpiration.
I — *Prunus Amygdalus*, II — *Ceratonia Siliqua*, III — *Olea europaea*.
W — western side; E — eastern side.

value of 554 (Table 1) when the maximal transpiration is expressed in per cent of water content per hour. As for exposure, we see that in all our trees the annual rate of transpiration is higher on the western than on the eastern side.

Comparing the transpiration curves with those of evaporation and relative humidity we may state:

1. There is complete correspondence between the course of evaporation and relative humidity.

2. The transpiration curves of the two sides of the almond tree run parallel to the evaporation curve.

TABLE 1

Average transpiration value in mg/g. min.

Month	OLIVE TREE East	OLIVE TREE West	CAROB TREE East	CAROB TREE West	ALMOND TREE East	ALMOND TREE West
J	0.87	1.51		2.26		
F			4.10	4.29		
M	1.25 *1.75	1.77 *0.69	5.56	6.25	16.03	14.61
A	1.63	2.00	3.28	4.10	11.54	13.59
M	5.43	4.46	2.29	5.33	15.05	24.35
J	5.57	5.61	2.67	5.03	13.75	16.70
J	4.56	4.00	2.97	3.40	14.03	13.23
A	3.60	4.80	3.00	3.85	16.10	13.37
S	3.27	4.40	3.77	4.35		
O	3.15	4.07	2.96	4.95		
N	2.30	2.79	1.96	2.56		
D	1.61	2.32	1.72	2.30		

Maximal transpiration value in mg/g. min.

Month	OLIVE TREE East	OLIVE TREE West	CAROB TREE East	CAROB TREE West	ALMOND TREE East	ALMOND TREE West
J	1.51	4.34		3.32		
F			6.87	7.99		
M	3.81 *2.25	4.86 *1.45	9.28	9.88	27.10	23.64
A	3.85	6.98	6.29	7.01	21.47	25.02
M	13.40	9.20	3.76	8.57	24.07	57.41
J	9.40	11.21	6.71	12.37	26.04	29.95
J	8.00	7.32	6.62	8.93	26.57	22.38
A	9.23	9.43	6.10	12.10	36.53	29.89
S	8.26	8.63	8.80	9.77		
O	6.46	10.22	6.24	8.72		
N	4.11	4.25	3.69	7.85		
D	3.02	3.60	3.07	8.33		

Maximal transpiration value in percents of water-content/hour

Month	OLIVE TREE East	OLIVE TREE West	CAROB TREE East	CAROB TREE West	ALMOND TREE East	ALMOND TREE West
J	19.8	55.3		36		
F			72	92		
M	48 *31.2	60.5 *18.5	102	111	228	205
A	49.5	102	98	75	198	236
M	168	119	37.5	82	225	554
J	99	120	65	121	265	295
J	90.5	79.5	67.5	80	241	220
A	—	110	64	125	293	380
S	99	100	93	102		
O	78	125	67	88		
N	43	52	42.5	79		
D	37	38	35	86		

* Values for a rainy day.

3. The first rise in the *Ceratonia* curve coincides with a depression in the evaporation curve. This is followed by a rise on the W-side conforming to the evaporation, and a fall on the E-side, which shows a deep depression at the same time, while the evaporation curve reaches a maximum. The course of the two curves from July on is parallel to the evaporation curve.

4. The curves of the olive tree are more or less parallel to the evaporation curves until August. From this time on the second rise is missing for the E-side.

5. The W-side transpiration for the almond and the olive is on the whole higher than the transpiration of the E-side. It is always so for *Ceratonia*. The maximum difference between the two sides occurs in *Amygdalus* with 33 mg/g/min.

(2) *Osmotic value and soil suction pressure*

Perusal of Table 2 indicates the following:

1. The suction pressure of the soil is lower than the osmotic value. There is only one exception for *Ceratonia* in July. Therefore the suction pressure of the soil is no limiting factor for our trees.

2. The osmotic value and the saturation deficit of *Amygdalus* rise to maxima before the shedding of the leaves. The lower values of August are to be explained by the fact that in this month the older leaves are already shed, whereas young leaves are still being formed (See Graph 1.).

TABLE 2

Month	OLIVE TREE			CAROB TREE			ALMOND TREE		
	suc. press. of soil in atm. 60 cm. depth	suc. press. of plant in atm.	sat. def. of plant in %	suc. press. of soil in atm. 60 cm. depth	suc. press. of plant in atm.	sat. def. of plant in %	suc. press. of soil in atm. 60 cm. depth	suc. press. of plant in atm.	sat. def. of plant in %
J				4.19	20.9				
F				7.20	27.9		7.20	18.8	5.5
M	4.19	37.8	16.0	4.19	22.1	4.0	5.30	18.9	3.2
A	4.19	28.4	13.0	4.19	29.5	5.8	4.80	22.6	18.4
M	4.19	20.2	20.0	*5.25 8.25	*21.9 17.9	*12.0 19.0	12.30		15.2
J	15.20	23.0	19.7	10.20	17.9	17.0	12.30	24.7	18.4
J	10.30	15.6	13.4	14.20	**10.0	14.8	14.30	26.4	29.7
A	16.20	27.4	21.2	12.30	20.2	13.0	18.30	24.7	18.8
S	16.20	29.5	17.0	16.20	20.0	18.5			
O	16.20	29.5	17.0	16.20	19.2	16.0			
N	10.30	42.6	15.7	16.20	21.1	13.2			
D	8.40	34.5	18.6	8.40	22.9	13.4			

* Upper number for the beginning of the month.
Lower number for the end of the month.

** New leaves only were used.

3. The astonishing fact of the marked decrease of the osmotic values of *Ceratonia* and *Olea* in midsummer is explained in the same way, i. e. young leaves are being formed while old leaves are being shed (Graph 1.). WALTER (1931) states that the lowest osmotic values correspond to the period when young leaves are formed.

4. The highest osmotic value is reached by *Olca* just before the first rain (Nov. 1939). This tree presents the highest average as well as the greatest fluctuation. The other two trees have lower values and fluctuations.

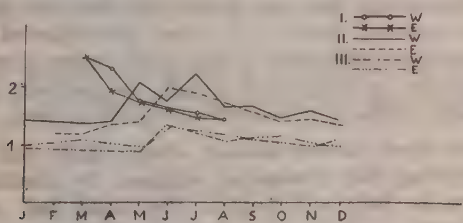
(3) *The $\frac{\text{water content}}{\text{dry weight}}$ ratio*

This ratio gives a good indication of the water content of the plant.

For *Ceratonia* and *Olea* its annual curves run almost without fluctuations, since there is only one rise in April-August (Graph 6) and this may be caused by the appearance of young leaves.

In the almond tree highest water content is connected with the development of young leaves and the curve falls exponentially to the leaf fall period.

The yearly curve of the above ratio for the olive tree is lowest of all the three trees.



Graph. 6. $\frac{\text{WATER CONTENT}}{\text{DRY WEIGHT}}$ RATIO — annual curve.

I — *Prunus Amygdalus*, II — *Ceratonia Siliqua*, III — *Olea europaea*.
W — western side, E — eastern side.

(4) *The water saturation deficit*

During the summer the water saturation deficit of the three trees is very similar, reaching about 20% (Table 2). For the almond the deficit increases gradually from the appearance of the leaves till the onset of shedding, reaching a maximum (29.7%) just before the abscission period. *Ceratonia* has the lowest average and maximum value. *Olea* has comparatively high values during the whole year and has a minimum fluctuation.

DISCUSSION

The three trees investigated belong to 2 different types so far as their water balance is concerned. Type 1 is represented by *Amygdalus*. This tree has mesomorphic leaves without any xeromorphic characters. It spends water freely as shown by its very high transpiration rate. The deep root system enables the almond tree to be a "water-spendthrift" as OPPENHEIMER (1932) calls it. In spite of this it can not always keep up its high rate of water expenditure. It has to cut down its transpiration sometimes during the day, especially when an eastern wind is blowing. The rising osmoting value as well as the rising water saturation deficit and the falling water content of the leaves show clearly that this tree gets into difficulties during the summer. In consequence it cuts down the transpiring surface by shedding the old leaves. It keeps the young leaves a bit longer and is leafless from the end of August onwards.

Type 2 is represented by *Olca* and *Ceratonia* which belong to the sclerophyll type. Their transpiration is low and regular in comparison with *Amygdalus*. The same is true of their water content and the water saturation deficit of the leaves in its yearly course. KILLIAN and FAUREL (1935) found the same for *Pistacia Lentiscus* and "sclerophytes" in general for which he states that they are "donnée, dans toutes les fonctions d'une stabilité remarquable..." (p. 41). The annual course of the osmotic value for *Ceratonia* is regular, while that of *Olea* is somewhat irregular. But the high rise for *Olea* in November does not prove that this tree has difficulties in getting the required water as it is not accompanied by a rise in the water saturation deficit and a fall in the water content. As previously pointed out by ROUSCHAL (1938) the osmotic value *alone* is *no* indicator of the water conditions inside a plant.

The two trees cannot balance water intake and expenditure without diminishing the transpiring surface by shedding part of their old leaves in July and August. We could find no sign of a summer dormancy such as suggested by GUTTENBERG and BUHR (1935). They stated that the Maquis plants during the drought period are "an der Grenze der Existenzmoeglichkeit" and that they show a summer "rest period".

OPPENHEIMER (1932) states the same for *Ceratonia*. Our observations do not bear out these statements. Our trees are physiologically active all the year round, at least so far as their water balance is concerned. *Olea* and *Ceratonia* could best be characterized as very thrifty in their water expenditure as shown by low transpiration rate, frequent closing of stomata and partial shedding of their leaves, processes which enable them to retain an even water balance during the entire year.

SUMMARY

(1) The root system of *Olea* and *Ceratonia* is limited to the shallow soil stratum covering the limestone rocks. Their roots do not enter the rock as do those of the almond tree, whose roots penetrate deeply into the limestone.

(2) The daily transpiration curves follow a double or triple apex curve or are irregular. The curves for the E and W side run parallel to each other, while on days with eastern winds the curves are inversely related. Marked changes in transpiration are almost always accompanied by stomatal movements.

(3) The annual transpiration curves are double apex curves. The maxima coincide more or less with the evaporation maxima. The transpiration rates for *Olea* and *Ceratonia* are very similar and low while that of *Amygdalus* is much higher. The transpiration rate of the W side is generally higher than that of the E side.

(4) The suction pressure of the soil is lower than the osmotic value of the tree. It is, therefore, no limiting factor in the water balance of the three trees.

(5) The osmotic values of *Ceratonia* and *Amygdalus* are comparatively low, whereas for *Olea* a high maximum value is reached shortly before the first rains.

(6) The almond is a "water spendthrift", whereas *Olea* and *Ceratonia* are much more thrifty in their water spending. They are characterized by a fairly regular yearly course of all the factors investigated.

(7) No summer dormany could be detected for *Olea* and *Ceratonia*, which are physiologically active all the year round.

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— (1935) 3. ibid. 81: 464—486.

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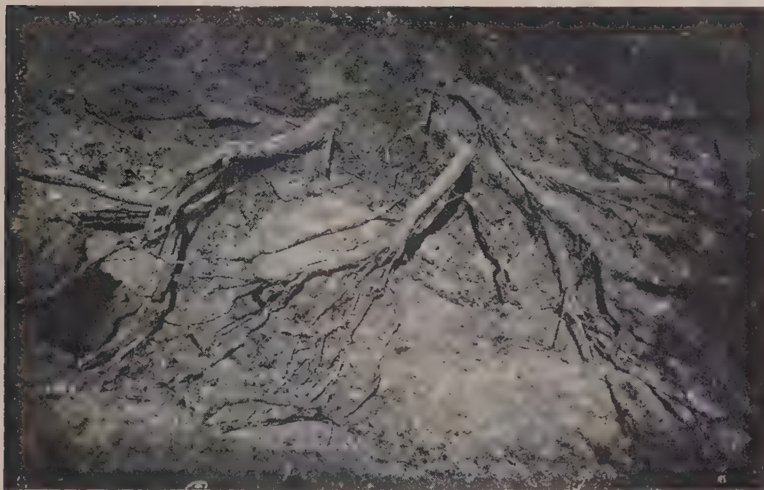
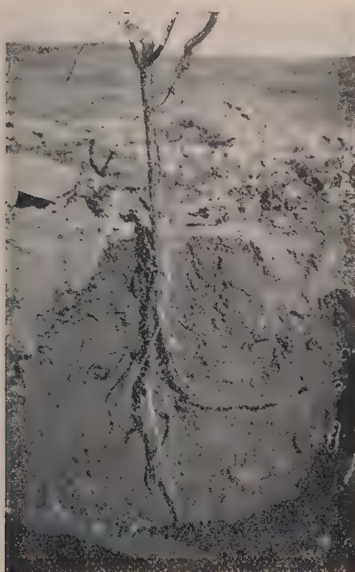


A



B

A: The root system of the olive tree
B: The root system of the almond tree

POLJAKOFF — ECOLOGICAL INVESTIGATIONS

NOUVELLE CONTRIBUTION À L'ÉTUDE DE LA MYCOFLORE DE PALESTINE (TROISIÈME PARTIE)

PAR T. RAYSS

(Avec huit figures dans le texte)

La présente contribution est notre onzième publication sur les champignons de la Palestine[1] et nous espérons qu'elle sera suivie de plusieurs autres au fur et à mesure que les matériaux récoltés par nous et par nos collaborateurs seront étudiés.

Dans nos publications précédentes nous avons traité à peu près tous les groupes de champignons (à l'exception des Hyménomycètes et des Gasteromycètes) et maintenant nous revenons sur les mêmes groupes, en ordre systématique, avec des matériaux qui ont été étudiés depuis. Dans ces contributions supplémentaires figureront des espèces qui n'ont pas encore été signalées dans nos publications précédentes, ou bien des espèces déjà indiquées par nous mais que nous avons retrouvées sur d'autres plantes hospitalières, ou bien encore des espèces dont nous avons pu compléter les diagnoses.

La présente contribution s'occupe des Archimycètes et des Phycomycètes et comporte 40 champignons dont 31 figurent pour la première fois dans la série de nos publications. Pour les 9 autres

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[1](I) SAVULESCU, TR. et RAYSS, T. (1935). Les espèces de *Cercospora* parasites des feuilles de vigne en Palestine. *Rev. Path. Vég. Ent. Agr.* 22: 221—241.

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(X) RAYSS, T. and ZWIRN, E. (1944). Some interesting *Ustilaginales* new to Palestine. *Pal. Journ. Bot.* J Series, 3: 114—116.

nous avons indiqué, entre parenthèses et en chiffres romains, le numéro correspondant de la publication où cette espèce a été indiquée par nous précédemment, selon la liste qui figure au commencement de cette contribution.

Avec notre publication sur les Deutéromycètes, le nombre de champignons étudiés par nous en Palestine a été 383; la note sur les Ustilaginales comporte encore huit espèces et le présent travail encore 31 espèces qui n'ont pas été indiquées par nous précédemment, de sorte que la liste de champignons étudiés par nous en Palestine comporte à présent 422 espèces.

Dans le présent travail nous décrivons trois espèces et une forme nouvelle, à savoir:

Peronospora Rumicis rosei Rayss sp. nov. — sur *Rumex roseus*
Peronospora Medicaginis orbicularis Rayss sp. nov. — sur *Medicago orbicularis*
Peronospora Veronicae Cymbalariae Rayss sp. nov. — sur *Veronica Cymbalaria*
Actinomucor corymbosus (Harz) N. Naumov, forma *palaestina* Rayss f. nov.

En dehors des espèces nouvelles, nous indiquons ici un certain nombre de plantes hospitalières nouvelles et c'est pour la première fois que nous donnons ici un certain nombre de champignons isolés du sol.

PARTIE SPECIALE III[1]

ARCHIMYCETES

Fam. *SYNCHYTRIACEAE*

1. Synchytrium anemones (DC) Woronin?

Sur les feuilles d'*Anemone Coronaria* L. J: Jérusalem, 10. III. 1943, Leg. E. Zwirn. Plante hospitalière nouvelle? Diamètre des cellules atteintes: 85—100μ; diamètre des spores durables: 65—75μ. Le champignon se trouve surtout aux extrémités des feuilles et les taches qu'il forme finissent par confluer en une croûte presque continue.

Nous déterminons notre champignon comme *Synchytrium anemones* d'une façon provisoire car le contenu de ses spores durables est coloré en jaune-orange (comme dans la section *Chrysochytrium*) tandis que le *Synchytrium anemones* typique a le contenu incolore et appartient à la section *Leucochytrium*. Ce champignon se trouve actuellement en étude.

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[1] Pour faciliter l'orientation dans de nombreuses localités que nous citons dans ce travail, nous avons adopté les abbréviations utilisées dans les autres travaux publiés dans ce journal. AP = Acre Plain; CA = Carmel; CS = Coastal Plain of Shephela; EP = Ezdraelon Plain; G = Gilead; HP = Huleh Plain; J = Judean Mountains; JD = Judean Desert; LG = Lower Galilee; LJ = Lower Jordan Valley; NN = Near Negeb; S = Sharon; SA = Samaria; UG = Upper Galilee; UJ = Upper Jordan Valley.

2. **Synchytrium Stellariae** Fuckel

Sur les feuilles de *Stellaria media* L. J: Wadi Ruas près Jérusalem, 20. II. 1943. Leg. E. Zwirn. Spores durables: 77—112μ, sphériques, renfermées dans de petites galles brunâtres. Sur cette plante hospitalière ce champignon est connu d'Allemagne, de Danemark et de la Russie.

PHYCOMYCETES

Fam. *PERONOSPORACEAE*

3 (IV, V). **Cystopus candidus** (Pers.) Lév,

Sur les feuilles de *Cardamine hirsuta* L. LG: Alonim, 5. IV. 1943. Leg. N. Feinbrun. Conidies: 15—20 × 13—18μ.

Sur les feuilles d'*Hirschfeldia adpressa* Moench. J: Jérusalem, 20. IV. 1939. Conidies: 15—23 × 15 — 18μ.

Sur les feuilles de *Lepidium spinosum* Ard. UG: Metula, 19. III. 1941. Plante hospitalière nouvelle? Conidies: 17—22 × 15—20μ.

Sur les feuilles de *Malcolmia crenulata* (L.) R. Br. LJ: bords du Jordain près Jéricho, 19. II. 1940. Plante hospitalière nouvelle? Conidies: 15—19×12—17μ.

Sur les feuilles de *Maresia nana* (DC.) Batt. CS: Bath-Yam, 2. IV. 1944. Conidies: 17—20 × 15—18μ.

Sur les feuilles de *Raphanus Raphanistrum* L. S: Kefar Saba, 3. IV. 1942; Magdiel, 2. IV. 1943; UG: Kefar Gileadi, 26. III. 1927. Conidies: 20—25 × 15—20μ.

Sur les feuilles, les tiges et les pièces florales de *Rapistrum rugosum* (L) All. S: Kefar Vitkin. 11. III. 1940. Produit des déformations notables de la tige et de l'inflorescence. EP: Sde Nahum, 16. IV. 1941. LP: Migdal, 17. IV. 1941. SA: Gilboa, 14. III. 1945. Conidies: 15—20 × 15—18μ.

Sur les feuilles, les pédicelles floraux, les fleurs et les fruits de *Sisymbrium officinale* (L.) Scop. UG: Dan, 5. V. 1942. Conidies: 15—18 × 12—15μ.

4 (IV, V). **Cystopus Tragopogi** (Pers.) Oudem., sensu ampl.

Sur les feuilles d'*Ifloga spicata* (Forsk.) Sch. Bip. S: Beth-Lid, 21.II.1945. Plante hospitalière nouvelle. Conidies: 15—19 × 12—17μ.

Sur les feuilles de *Lagoseris bifida* (Vis.) F. et M. Sa: entre Wadi Far'a et Nablus, 1. III. 1942. Plante hospitalière nouvelle? Conidies: 17—23×17—21μ.

Sur les feuilles de *Phagnalon rupestre* (L.) DC. J. Saris, 7. III. 1945. Ce champignon a été indiqué sur *Phagnalon saxatile* (L.) Cass. en Alger et au Maroc (Maire et Werner) et sur *Phagnalon calycinum* (Cav.) DC. au Maroc (Maire et Werner). Conidies: 15—20 × 12—18μ.

Sur les feuilles d'*Urospermum picroides* (L.) Schmidt. J: Jérusalem, 10. IV. 1942. Leg. H. Habelska. Plante hospitalière nouvelle? Conidies: 20—25 × 15—20μ.

5. **Pseudoperonospora cubensis** (Berk. et Curt.) Rostovzev

Sur les feuilles de *Cucumis sativus* L. S: Tel Shalom près Pardess-Hanna, 31. VII. 1942. Leg. S. Duvdevani. A été indiqué en Palestine par I. Reichert (1939). Longueur du conidiophore: 205—250μ; son diamètre: 6—8μ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 3/5—4/5; nombre de dichotomies: 3—4; conidies: 20—28 × 16—20μ.

Ce champignon apparaît en plein été, beaucoup plus tard que toutes les autres Péronosporacées de Palestine, probablement en correlation avec les rosées abondantes dans la plaine côtière. S. DUVDEVANI a enterpris une série de recherches pour élucider cette question.

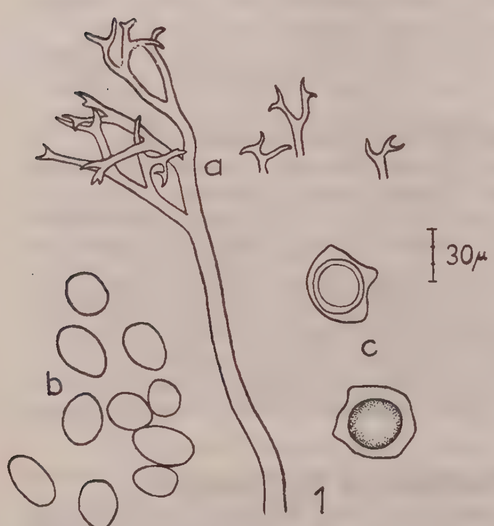
6 (IV. V). **Pseudoperonospora Erodii** (Fuckel) Wilson

Sur les feuilles d'*Erodium malacoides* (L.) Willd.: CA: Beth-Oren, 4. V. 1943. Longueur du conidiophore: 250—425μ; son diamètre: 9—15μ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 1/2—3/7; nombre de dichotomies: 5—6; conidies: 20—30 × 18—28μ.

7. **Peronospora Rumicis rosei** Rayss, sp. nov. Fig. 1 et 2

Caespitulis densis, brunneo-violaceis, totum tergum foliorum subtegentibus. Conidiophoris singulis vel 2—3 e stomatibus exeuntibus, 300—500μ altis, trunco 1/2—3/5 totius altitudinis efficienti, 7—12μ crasso; ramis 5—7ies dichotome ramosis, undulatis; furcis terminalibus rectangulis, leviter curvatis vel rectis. Conidiis leviter brunneis, ellipsoideis vel ovoideis, 17,5—40, fere 23—33μ longis, 12,5—27,5, fere 17—20μ. latis. Longitudine media: 28,45μ; latitudine media: 20,25μ. Oosporis globosis, 30—36μ diam., episporio flavo, laevi.

Habitat in foliis vivis *Rumicis rosei* L.: JD: in deserto Jehuda, 3. I. 1937; LP: Jericho, 11. II. 1935.



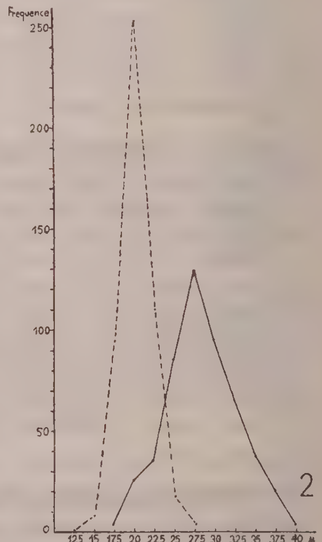


Fig. 1 et 2. *Peronospora Rumicis rosei* Rayss. Fig. 1. a— conidiophores, b — conidies, c — oospores. Fig. 2. Courbe de la variation de la longueur (ligne entière) et de la largeur (ligne pointillée) de 500 conidies.

Sur les espèces diverses de *Rumex* on ne connaît jusqu'à présent qu'un seul *Peronospora*: le *P. Rumicis* Corda. Nous avons établi par des mesures de tous les organes et la courbe de variation de 500 conidies que le *Peronospora* parasitant l'*Emex spinosus* en Palestine (et c'est probablement le cas pour l'*Emex spinosus* de Tunisie et d'autres pays) appartient à l'espèce *Peronospora Rumicis* Corda (voir Rayss, 1938, p. 150). L'espèce nouvelle que nous décrivons ici sur *Rumex roseus* se distingue du *P. Rumicis* par ses conidies plus longues (longueur moyenne pour *P. Rumicis* = 25,38μ) et plus larges (la largeur moyenne pour *P. Rumicis* = 19,23μ), mais l'index reste à peu près le même (1,32 pour *P. Rumicis,* 1,35 pour *P. Rumicis rosei*). En plus, on ne connaît point jusqu'à présent des organes sexués chez *P. Rumicis;* notre espèce développe des oospores en assez grande quantité.

Maire et Werner (1937) indiquent au Maroc sur *Rumex vesicarius* L. le *Peronospora Rumicis* Corda. *Rumex roseus* est une espèce voisine du *R. vesicarius* et il serait intéressant de vérifier, en établissant des courbes de variation pour la longueur et la largeur de 500 conidies, si ce champignon est en effet le *P. Rumicis* ou bien le *P. Rumicis rosei.*

8. **Peronospora Holostei** Caspary

Sur les tiges, les feuilles et les pièces florales d'*Holosteum umbellatum* L. J: Jérusalem, 20. II. 1939. Longueur du conidiophore: 230—400μ; son diamètre: 7—14μ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 1/3—1/2; nombre de dichotomies: 4—6; conidies: 18—28 × 16—21μ; oospores: 37—53μ.

9. **Peronospora Euphorbiae** Fuckel

Sur les feuilles d'*Euphorbia Peplus* L. NN: Wadi Gaza, 16. I. 1943. CS: Tel Aviv, 20. III. 1941; Sarafand, 13. III. 1941; Petah-Tikvah, 18. I. 1941. J: Ein-Karem, 25. I. 1941; Silwan, 24. I. 1943. CA: Wadi Shumriyeh, 5. IV. 1942. UG: Dan, 20. II. 1941. Plante hospitalière nouvelle. Longueur du conidiophore: 200—650μ; son diamètre: 7—10μ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 2/5 — 5/7; nombre de dichotomies: 5—7; conidies: 10—25 ×7,5—20μ; pour la plupart; 13—18 ×12—16μ; longueur moyenne: 15,95μ; largeur moyenne: 13,87μ; index: 1,12.

Nos valeurs correspondent assez bien à celles de Gaeumann (1919) pour *Peronospora Euphorbiae* sur *Euphorbia platyphylla* (longueur moyenne: 15,78μ; largeur moyenne: 14,37μ; index: 1,10) et c'est pourquoi nous rapportons notre plante à cette espèce.

10 (V). **Peronospora affinis** Rossman **Fig. 3**

Sur les feuilles, les tiges et les parties florales de *Fumaria parviflora* Lam. J: Jérusalem, 2. VI. 1935; Kiryath-Anavim, 25. I. 1940. Produit une déformation notable de la plante attaquée. Plante hospitalière nouvelle? Longueur du conidiophore: 265—330μ; son diamètre: 8—10μ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 4/5; nombre de dichotomies: 4—5; conidies: 13,8—25,3 × 11,5—23μ; la majorité des conidies mesurent: 18—23 × 13—20μ; longueur moyenne: 19,1μ; largeur moyenne: 16,9μ;

index: 1,13. (Pour les valeurs moyennes et l'index nous avons effectué comme d'habitude 500 mesures); oogones: 30—50μ; oospores: 25—36μ.

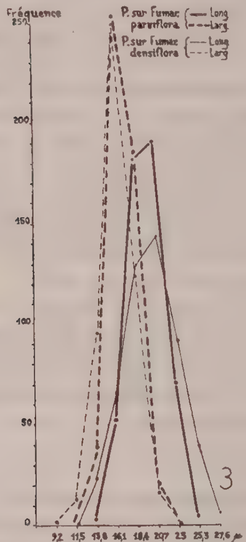


Fig. 3. *Peronospora affinis* Rossman. Courbes de la variation de la longueur et de la largeur de 500 conidies de *Peronospora affinis* sur *Fumaria parviflora* et *Fumaria densiflora.*

Notre champignon correspond par tous ses caractères au *Peronospora affinis,* avec de petites différences toutefois. A savoir: (1) ses conidies sont un peu plus rondes (l'index de *P. affinis* typique = 1,4; l'index du *Peronospora* sur *Fumaria parviflora* = 1,13; sur *Fumaria densiflora* = 1,2. — RAYSS, 1938, p. 153). (2) ses conidiophores portent un plus grand nombre de dichotomies (*P. affinis* typique: 2—3; sur *Fumaria parviflora*: 4—5; sur *Fumaria densiflora*: 3—5). Ainsi donc le *Peronospora* sur *Fumaria parviflora* ressemble davantage à celui sur *Fumaria densiflora* qu'au *Peronospora affinis* typique. Du reste, le *Fumaria parviflora* infecté se trouve souvent dans le voisinage immédiat du *Fumaria densiflora* malade et il est fort probable que le champignon passe d'une plante hospitalière à l'autre.

11 (IV, V). Peronospora Brassicae Gaeum.

Sur les feuilles de *Raphanus sativus* L. J: Talpioth, 19. I. 1943. Leg. H. Habelska. Longueur du conidiophore: 275—550μ; son diamètre: 10—15μ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 1/3—1/2; nombre de dichotomies: 6—7; conidies: 20—25 $\times$ 15—20μ. Ce champignon se trouve ensemble avec *Cystopus candidus* et forme autour des pustules de *Cystopus* une couronne de ses conidiophores.

12. Peronospora Matthiolae Gaeum.

Sur les feuilles de *Matthiola incana* R. Br. J: Talpioth, 10. III. 1939. Leg. L. Weber LJ: Beth-Arava, 5. III. 1945. Longueur du conidiophore: 170—185μ; son diamètre: 5—7μ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 1/2—2/3; nombre de dichotomies: 5—6; conidies: 19—23 $\times$ 17—20μ.

13 (IV, V). Peronospora conglomerata Fuckel

Sur les feuilles de *Geranium dissectum* L. UG: Metula, 19. III. 1941. Longueur du conidiophore: 200—400µ; son diamètre: 7—9µ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 1/3—1/2; nombre de dichotomies: 4—6; conidies: 22—28 × 20—26µ.

14. Peronospora aestivalis Syd.

Sur les feuilles de *Medicago sativa* L. CS: Rehovot, 3. IV. 1935. Leg. I. Reichert; CS: Mikweh-Israel, 4. III. 1942; S: Tul-Karem, école Kadoorie, 13. III. 1935. Longueur du conidiophore: 220—450µ; son diamètre: 7—9µ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 1/3—3/4; nombre de dichotomies: 3—6; conidies: 20—30 × 15—21µ.

15. Peronospora astragalina Sydow in litt.

Sur les feuilles d'*Astragalus hamosus* L. J: Jérusalem, 21. II. 1935; Motsa, 14. XII. 1937; JD: Désert Jéhuda, 12. II. 1935. Longueur du conidiophore: 275—400µ; son diamètre: 10—12µ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 1/2—2/3; nombre de dichotomies: 6—8; conidies: 15—30 × 12,5—22,5µ, pour la plupart: 20—26 × 16—20µ; longueur moyenne: 22,67µ; largeur moyenne: 17,4µ; index: 1,3.

Cette espèce a été décrite sur les *Astragalus alpinus* et *A. oroboides* en Europe et notre champignon lui correspond assez bien: les différences sont si petites que cela ne nous autorise pas d'en faire une espèce nouvelle.

16. Peronospora Medicaginis orbicularis Rayss, sp. nov. Fig. 4 et 5

Caespitulis mollissimis, griseo-violaceis, totum tergum foliorum subtegentibus. Conidiophoris singulis vel plurimis (3—4)

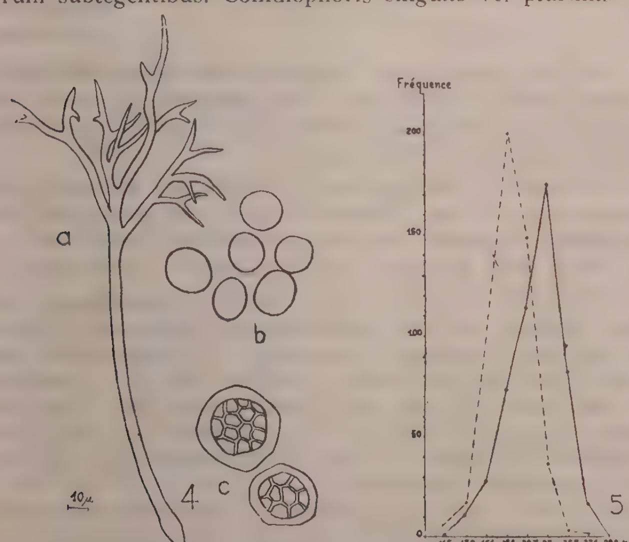


Fig. 4 et 5. *Peronospora Medicaginis orbicularis* Rayss. Fig. 4. a — conidiophore, b — conidies, c — oospores. Fig. 5. Courbe de la variation de la longueur (ligne entière) et de la largeur (ligne pointillée) de 500 conidies.

e stomatibus exeuntibus, 350—450μ altis, trunco 1/3—2/3 totius altitudinis efficienti, 7—9μ crasso; ramis 5—8ies dichotome ramosis, curvatis. Conidiis leviter brunneis, ellipsoideis, 11,5—29,9μ, fere 18—25μ longis, 11,5—27,6 fere 16—21μ latis. Longitudine media: 21,78μ; latitudine media: 18,86μ. Oosporis creberrimis in foliis marcidis, globosis, 32—38μ diam., episporio flavo, irregulariter reticulato.

Habitat in foliis vivis *Medicaginis orbicularis* All.: Jerusalem, 21. II. 1935.

Sur les *Medicago* on connaît jusqu'à présent trois espèces de *Peronospora*: *P. aestivalis* Sydow sur *Medicago sativa; P. romanica* Savul. et Rayss sur *Medicago falcata* var. *romanica* et *P. Savulescui* Rayss sur *Medicago hispida*. Dans le tableau comparatif qui suit nous indiquons les différences entre ces trois espèces et la nôtre.

Espèces	Conidiophores	Longueur	Largeur	Index	Oospores
P. romanica	240-450μ	20,13μ	17,5μ	1,15	36-45μ, réticulées (*Sect. Reticulatae*)
P. Medicaginis	350-450μ	21,78μ	18,86μ	1,15	32-38μ, reticulées (*Sect. Reticulatae*)
P. Savulescui	160-300μ	23,46μ	19,9μ	1,18	30-32μ, recouvertes par de grosses verrucosités (*Sect. Verrucosae*)
P. aestivalis	200-500μ	27,01μ	20,45μ	1,32	20-30μ, lisses ou rarement rugueuses (*Sect. Effusae*)

Ainsi donc, notre espèce occupe une place intermédiaire entre le *P. romanica* et le *P. Savulescui* et se rapproche davantage de *P. romanica* par ses oospores réticulées et par son index; mais ses conidies sont plus grandes et ses oospores plus petites.

En donnant la diagnose latine du *Peronospora aestivalis* Gaeumann remarque (1923, p. 201): "Habitat in foliis vivis *Medicaginis sativae* L. *Peronosporae* formae in foliis *Med. denticulatae* Willd., *Med. falcatae* (L.) Doell., *Med. lupulinae* L., *Med. mediae* Pers. nec non *Med. minimae* (L.) Bartal. huc pertinere videntur". Et un peu plus loin: "Die biologische Identitaet der *Peronospora*formen auf diesen sechs *Medicago*arten ist noch nicht experimentell nachgewiesen. Infektionsversuche haben im Gegenteil die Wahrscheinlichkeit nahegelegt, dass die *Peronospora*form von *Med. sativa* nicht auf *Med. lupulina* ueberzugehen vermag und umgekehrt. Immerhin moechte ich vor der Aufstellung besonderer biologischer Unterarten das Ergebnis von fernern Infektionsversuchen abwarten." Or, nous avons décrit en Roumanie sur *Med. falcata* f. *romanica* une espèce de *Peronospora* morphologiquement bien distincte du *P. aestivalis;* nous avons décrit en Palestine sur *Med. hispida* (dont *Med. denticulata* est une sous-espèce ou variété) une autre espèce nouvelle, morphologiquement bien différente du *P. aestivalis*; nous décrivons ici une troisième espèce nouvelle —sur *Med. orbicularis*. Nous possédons en outre dans notre herbier de

Palestine quelques autres espèces de *Medicago* parasitées par les *Peronospora* dont l'étude détaillée sera faite prochainement et sera accompagnée par des expériences d'infection croisée. Dès à présent il apparait que la spécialisation des *Peronospora* parasitant les différentes espèces de *Medicago* est du moins tout aussi grande que celle des *Peronospora* parasitant différentes espèces de *Trifolium* ou de *Vicia* et il s'agit ici non seulement des "biologische Unterarten" mais de vraies espèces morphologiquement distinctes.

17. **Peronospora Meliloti** Sydow

Sur les feuilles de *Melilotus indicus* (L.) All. CS: Tel-Aviv, bords du Yarkon, 10.IV.1941. Longueur du conidiophore: 500—520µ; son diamètre: 7—9µ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 3/4-3/5; nombre de dichotomies: 5-6; conidies: 22-30×14-22µ.

18 (V). **Peronospora Tetragonolobi palaestini** Rayss Fig. 6

Sur les feuilles de *Tetragonolobus palaestinus* Boiss. S. Kefar Vitkin, 8.IV.1938. Dans le matériel de Kefar Vitkin se trouvent des oospores qui n'ont pas été décrites précédemment et ceci nous permet de compléter la diagnose de notre espèce.

Oosporis creberrimis in foliis marcidis, globosis vel late ellipsoideis, 25-38µ diam., episporio flavo, irregulariter reticulato.

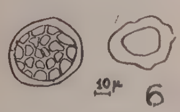


Fig. 6. *Peronospora Tetragonolobi palaestini* Rayss. Oospores.

19. **Peronospora leptoclada** Sacc.

Sur les feuilles de *Helianthemum salicifolium* Mill. J: Jérusalem, 28.III.1934; Talpioth, 19.III.1942. Leg. H. Habelska; Beth Hakerem, 30.IV.1939. Longueur du conidiophore: 212-400µ; son diamètre: 10-15µ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 2/5-3/4; nombre de dichotomies: 4-5; conidies: 15-30×15-25µ.

Ce champignon a été indiqué sur cette même plante hospitalière en Russie (Jaczewski, p. 138).

20. **Peronospora Arthuri** Farlow

Sur les feuilles de *Clarkia elegans* Douglas cult. CS: Rehovot, 1.IV.1940. Longueur du conidiophore: 300-400µ; son diamètre: 5-8µ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 3/5-2/3; nombre de dichotomies: 3-5; conidies: 22-30×18-22µ.

Cette espèce a été indiquée sur cette plante hospitalière au Maroc par Berger (1938).

21. **Peronospora Antirrhini** Schroeter

Sur les feuilles d'*Antirrhinum Orontium* L. CS: Magdiel, 2.IV.1942. Leg. H. Habelska. Longueur du conidiophore: 185-350µ; son diamètre: 7-10µ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 1/2-3/5; nombre de dichotomies: 5-6; conidies: 20-25×15-18µ.

22. **Peronospora Veronicae Cymbalariae** Rayss sp. nov. **Fig. 7 et 8**

Caespitulis mollibus leviter griseo-brunneis, tergum foliorum nonnulla parte subtegentibus. Conidiophoris fere 1-3 e stomatibus exeuntibus, 217-350μ altis, trunco 1/3-2/3 totius altitudinis efficienti, 7-10μcrasso, basi leviter tumida. Ramis 4-5ies dichotome ramosis, leviter curvatis. Furcis terminalibus rectangulis, leviter curvatis, 8-30μ longis. Conidiis leviter brunneis, 20-35 fere 26-32μ longis, 15-27 fere 18-24μ latis. Longitudine media: 28.75μ, latitudine media: 20,75μ. Oosporis creberrimis in foliis marcidis, 35-60μ diam., episporio flavo late reticulato.

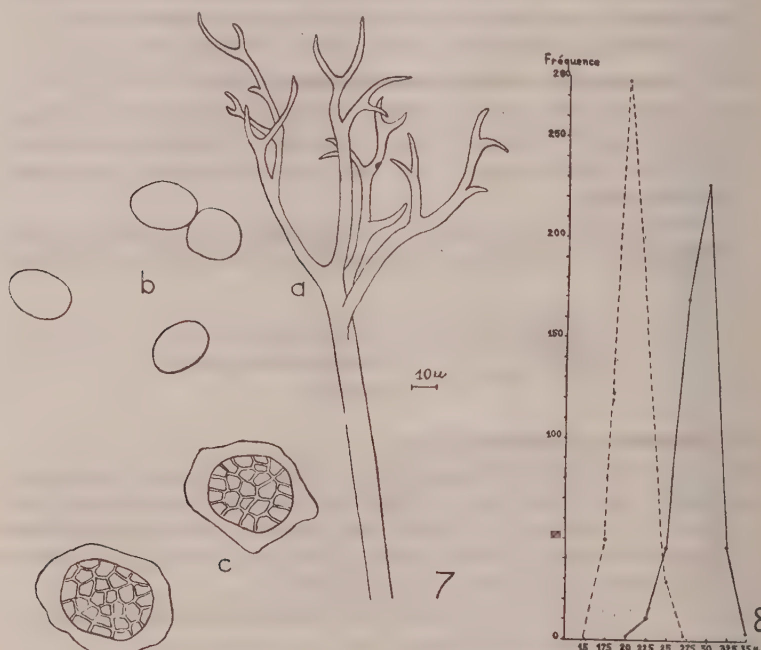


Fig. 7 et 8. *Peronospora Veronicae Cymbalariae* Rayss. Fig. 7 a — conidiophore, b — conidies, c — oospores. Fig. 8. Courbe de la variation de la longueur (ligne entière) et de la largeur (ligne pointillée) de 500 conidies.

Habitat in foliis vivis *Veronicae Cymbalariae* Bod. J: Jérusalem, 5.III.1937; Étangs du roi Salomon près Bethléem, 20.II. 1943; Aquabella, 2.II.1942; Silwan, 9.I.1943.

Un *Peronospora* a été indiqué sur *Veronica Cymbalaria* Bodard par Jaap en Dalmatie (1916), mais, comme le dit Gaeumann (1923, p. 161), "noch nicht naeher untersucht und daher in ihrer Stellung noch unsicher".

Nous donnons ci-dessous un tableau comparatif des caractères des *Peronospora* qui parasitent sur les différentes espèces de *Veronica*.

Plante parasiteé	Espèce de *Peronospora*	Longueur moyenne	Largeur moyenne	Index
Veronica polita	(*Per. agrestis* Gaeum.)	19,07	15,24	1,24
V. serpyllifolia	(*Per. verna* Gaeum.)	20,90	17,76	1,18
V. Beccabunga	(*Per. grisea* Unger)	23,65	16,10	1,47
V. hederifolia	(*Per. arvensis* Gaeum.)	24,67	21,28	1,16
V. scutellata	(*Per. palustris* Gaeum.)	27,46	18,66	1,47
V. Cymbalaria	(*Per. Veronicae Cymbalalariae* Rayss)	28,75	20,75	1,33
V. fruticans	(*Per. silvestris* Gaeum.)	31,74	19,94	1,59
V. Anagallis	(*Per. aquatica* Gaeum.)	35,26	21,02	1,68

23. Peronospora Sherardiae Fuckel

Sur les feuilles de *Sherardia arvensis* L. UG: Kefar Gileadi, 19. III.1940; Daphne, 21.III.1941. CA: Beth Oren, 5.IV.1943. S: Nathania, 21.II.1945. Longueur du conidiophore: 250-400μ; son diamètre: 10-12μ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 2/3; nombre de dichotomies: 5-6; conidies: 18-25×14-19μ.

24 (IV V). Bremia Centaureae Sydow

Sur les feuilles de *Centaurea hyalolepis* Boiss. J: Jérusalem, 21.II.1935. Longueur du conidiophore: 400-550μ; son diamètre: 8-10μ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 1/2-4/7; nombre de dichotomies: 3-4; conidies: 16-20×15-18μ.

25 (IV, V). Bremia Lactucae Regel

Sur les feuilles de *Carthamus tenuis* Boiss. JD: Désert Jéhuda, 3.I.1945. Plante hospitalière nouvelle? Longueur du conidiophore: 500—650μ; son diamètre: 8-10μ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 2/3; nombre de dichotomies: 4-5; conidies: 17-22×15-18μ.

Sur les feuilles de *Crepis aspera* L. J: Jérusalem, 19.III.1945. Leg. E. Zwirn. Plante hospitalière nouvelle? Longueur du conidiophore: 450-1000μ; son diamètre: 6-10μ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 5/8-4/5; nombre de dichotomies: 4-6; conidies: 15-18× 12-17μ.

Sur les feuilles de *Crepis bulbosa* (L.) Tausch. S: Yarkon, Esser Tahanoth, 4.III.1942. Plante hospitalière nouvelle? Longueur du conidiophore: 400-580μ; son diamètre: 8-11μ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 1/2-3/4; nombre de dichotomies: 3-5; conidies: 17-20×15-18μ.

Sur les feuilles de *Picris galilaea* (Boiss.) Benth. et Hook. LJ: Jéricho, 14 II.1940. Plante hospitalière nouvelle? Longueur du conidiophore: 300-650μ; son diamètre: 8-12μ; rapport entre le tronc non ramifié du conidiophore et sa longueur totale: 1/2-2/3; nombre de dichotomies: 4-6; conidies: 17-25×15-20μ.

Sur les feuilles de *Lagoseris bifida* (Vis.) F. et M. J: Jérusalem, 30.III.1942. Leg. H. Habelska. Plante hospitalière nouvelle? Longueur du conidiophore: 350-450μ; son diamètre: 7-10μ; rapport entre le tronc non ramifié du

conidiophore et sa longueur totale: 1/2-2/3; nombre de dichotomies: 5-7; conidies: 15-18×13-18μ.

Fam. *MUCORACEAE*

26. **Absidia glauca Hagem** (Syn.: Tieghemella glauca Hagem; Tieghemella Tieghemii N. Naumov).

J: dans l'humus sous *Pinus halepensis,* jardin de l'Université Hébraique de Jérusalem, 28.XII.1940. Isolé par Z. Fisch. Les sporanges apparaissent par groupes de 2-4 sur la partie incurvée des stolons. Sporanges piriformes mesurant 45-60×40-50μ; columelle arrondie, mammiforme, munie d'un court bouton, 35×30μ; spores rondes, 3-5μ de diam.; espèce hétérothallique.

D'après les expériences de notre élève Z. Fisch, ce champignon ensemencé sur le milieu Czapek et maintenu à 28°C. développe à la lumière un mycélium haut de 5mm. et à l'obscurité de 1 mm. seulement; il se développe bien à la t° de 28-30°C, mais à 34° le développement devient anormal et s'arrête à 35°C; pH optimum=8.

Ce champignon a été isolé du sol de plusieurs endroits en Europe et en Amérique, de même qu'en Egypte (Sabet, 1935, 1939).

27. **Absidia spinosa** Lendner (Syn.: Tieghemella cylindrospora Hagem, Thieghemella spinosa N. Naumov).

J: isolé à plusieurs reprises du sol dans le jardin de l'Université Hébraique de Jérusalem, sous *Pinus halepensis.* Sporangiophores plutôt rares, paraissent isolés ou par groupes de 2-3 sur la partie légèrement incurvée du stolon; sporanges piriformes, 34-35×27-28μ; columelle 20μ de diam., terminée en pointe assez longue; apophyse sous forme d'entonnoir; spores allongées, 4-5×2μ. Espèce homothallique formant des zygospores en grande quantité; zygospores sphériques ou doliformes, verruqueuses, résultant de la fusion de deux gamétanges inégaux; fulcres longs et circinés partant du côté du gamétange le plus vigoureux.

D'après les expériences de Z. Fisch, ce champignon développe dans l'obscurité beaucoup plus de zygospores qu'à la lumière; en déficit d'azote les zygospores ne se forment point. Le développement de ce champignon s'arrête à la température de 34°C; le pH optimum est 5.

Ce champignon a été isolé du sol de plusieurs localités en Europe, Afrique et Amérique.

28. **Actinomucor corymbosus** (Harz) N. Naumov (Syn.: Mucor corymbosus Harz; Actinomucor repens Schostakowitsch; Glomerella repens Bainier; Mucor Glomerula Lendner; Rhizopus elegans Eidam).

Forma **palaestina** Rayss f. nov.

J.: isolé du sol dans le jardin de l'Université Hébraique de Jérusalem par notre élève A. Sonnenschein hiver 1944-1945. Sporangiophores dressés, ramifiés: sporange terminal: 82-102μ (dans la diagnose: 120-180μ de diam.); sporanges latéraux disposés en verticille, 37-50μ de diam. (dans la diagnose: jusqu'à 30-45μ); spores sphériques, 7-10μ de diam. (diagnose: en moyenne 7μ).

Notre champignon se distingue de l'*Actinomucor corymbosus* typique par ses sporanges principaux plus petits et par ses spores un peu plus grandes. Tous les autres caractères et l'apparence du champignon sont conformes à la description du type.

La forme typique a été isolée du sol en Angleterre, France, Tchécoslovaquie, Yougoslavie et USSR, de même que de plusieurs localités en Amérique.

29. **Mucor griseo-cyanus** Hagem (sect. Heteropus N. Naumov, sect. Racemosus Zycha).

J: Isolé du sol dans le Jardin Botanique de l'Université Hébraique de Jérusalem par notre élève A. Krugliakov, le 5.11.1946. Sporangiophores disposés en deux étages, l'inférieur de couleur gris-foncé, à cause de sporanges très nombreux dans cette zone. Sur le pain le gazon s'élève à 1,5 cm.. sur le riz — à 2 cm. (dans la diagnose de LENDNER: gazon bleuâtre foncé, s'élevant à 1 cm); sporanges sphériques, 57-75μ de diam., à membrane non diffluente, colorée en gris-bleu; columelles rondes ou ovales, incolores ou très faiblement colorées (d'après LENDNER, elles sont colorées en brun clair fuligineux); leurs dimensions: 28-45×25-30μ; spores ovales, 4-6×3-4μ.

A été isolé du sol dans plusieurs localités d'Europe, a été trouvé également en Egypte (SABET, 1935, 1939) et en Amérique.

30. **Mucor griseo-lilacinus** Povah (sect. Heteropus N. Naumov; sect. Hiemalis Zycha).

J: Isolé du sol dans le Jardin Botanique de l'Université Hébraique de Jérusalem par A. Krugliakov, le 10.II.1946. Colonies gris-souris, 1-1.5 cm. de hauteur; ramification sympodiale. Sporanges 50-70μ de diam., jaunâtres au début, puis d'un gris foncé; columelle sphérique, 17,5-30μ de diam., gris-lilas; spores ovales, 4,5×3-4,5μ.

Jusqu'à présent n'a été trouvé dans le sol qu'en Amérique (Illinois).

31. **Mucor ambiguus** Vuillemin (sect. Bonordenia N. Naumov; sect. Fragilis Zycha).

CS: Bath-Yam, dans la terre prise sous *Cymodon Dactylon*, 18.XII. 1940. Isolé par Z. Fisch. Sporangiophores dressés formant un gazon bas (1 mm.), gris-noirâtre; sporanges terminaux sphériques, 100μ de diam., leur membrane plus ou moins diffluente; les sporanges successifs sont de plus en plus persistants et leur membrane se déchire en lambeaux; columelle campanulée ou globuleuse. Spores elliptiques, 7×4-5μ; chlamydospores nombreuses.

Jusqu'à présent n'a été isolé du sol qu'en Amérique (Michigan).

32. **Mucor plumbeus** Bonorden (sect. Bonordenia N. Naumov; sect. Sphaerosporus Zycha).

J: isolé du sol dans le Jardin Botanique de l'Université Hébraique de Jérusalem par A. Krugliakov, le 10.II.1946. Forme un gazon très serré, de 1 cm. de hauteur, couleur gris souris; sporangiophores ramifiés en sympodes, le plus souvent 7-9μ de diam., mais quelquefois atteignant 20-23μ

de diam., sporanges: 80-105μ de diam. (plus petits que ne le veut la diagnose: 100-130μ); columelles ovales ou piriformes, brunâtres ou enfumées, avec des appendices spinescents en nombre et de grandeur variables; dimension de la columelle: 62-70×22,5-27μ. Spores sphériques, de couleur grisbleuâtre, 5-7,5μ de diam.

A été isolé du sol dans plusieurs localités d'Europe et d'Amérique.

33. Mucor adventitius Oudemans (Syn.: Mucor humicolus Raillo; Sect. Hagemia N. Naumov; sect. Hiemalis Zycha).

CS: Bath-Yam, isolé de la terre sablonneuse, sous *Ficus Sycomorus*, par Z. Fisch, le 12.XII.1940. Forme un gazon de 2 cm. de haut; sporanges 75-80μ de diam., à membrane diffluente; columelle elliptique, 40-48×60μ, munie de collerette à la base. Spores elliptiques ou allongées, grisâtres en masse, 7-8×3-5μ.

D'après les expériences de Z. Fisch, ce champignon forme à la lumière un gazon 5 fois plus haut qu'en obscurité, son dévèloppement cesse à la température de 35°C et le pH optimum est 6.

Ce champignon a été trouvé dans le sol en Europe et en Asie (Chine, Japon).

34. Mucor hiemalis Wehmer (sect. Hagemia N. Naumov; sect. Hiemalis Zycha).

J: Isolé du sol dans le Jardin Botanique de l'Université Hébraique à Jérusalem par A. Krugliakov, le 10.XI.1945. Colonies d'abord blanches ensuite d'un gris-jaunâtre, atteignant la hauteur de 2 cm. (sur le pain). Sporanges sphériques, 45-58μ de diam.; columelles sphériques ou ovales, 30-33×30μ; spores lisses, pour la plupart allongées, 5-8×3-4μ. Ce champignon sécrète des gouttes d'huile de couleur jaune qui colorent d'une façon intense le mycélium et même le milieu de culture.

Ce champignon a été isolé du sol de beaucoup de localités en Europe et en Amérique.

35. Mucor geophilus Oudemans (sect. Hagemia N. Naumov; sect. Racemosus Zycha).

J: Isolé du sol dans le Jardin Botanique de l'Université Hébraique à Jérusalem, sous *Casuarina tenuissima*, le 4.XI.1940, par Z. Fisch. Colonies d'abord blanc de neige ensuite olivâtres. Sporangiophores longs, simples ou ramifiés en cymes; sporanges globuleux, 50-60×30-40μ, jaunes quand ils sont jeunes, devenant olivâtres ensuite; columelle globuleuse, pourvue de collerette; spores lisses, sphériques ou elliptiques, 4-7μ de diam.; chlamydospores nombreuses, rondes, 20μ de diam.

Les expériences de Z. Fisch ont montré que le développement de ce champignon cesse déjà à 30°C; le pH optimum est 6.

A été isolé du sol seulement en Hollande et aux Etats Unis.

36. Mucor racemosus Fresenius (sect. Byssomucor N. Naumov, sect. Racemosus Zycha).

J: Isolé du sol dans le Jardin Botanique de l'Université Hébraique à Jérusalem, sous *Poa bulbosa*, le 25.XII.1940, par Z. Fisch. Gazon blancjaunâtre formé par des sporangiophores de hauteur variable, ramifiés en

grapes; sporanges sphériques, 20-60μ de diam., à membrane non diffluente, fragile, laissant une collerette. Columelles ovoides ou campanulées, atteignant la longueur de 50μ, larges de 8-30μ à la base, de 10-40μ dans leur partie la plus large; spores elliptiques, de grandeur variable, pour la plupart: 7-10×3-8μ. Chlamydospores très nombreuses, surtout sur le mycélium, de forme sphérique, elliptique ou cylindrique.

Isolé du sol de très nombreuses localités en Europe et en Amérique; indiqué aussi au Japon.

37. **Mucor Mucedo** (Linné) Brefeld (Syn.: Mucor brevipes Riess; Mucor proliferus Schostakowitsch; sect. Macromucor N. Naumov; sect. Mucedo Zycha).

J: Isolé du sol dans le Jardin Botanique de l'Université Hébraique à Jérusalem, le 5.I.1946, par A. Krugliakov. Sporangiophores dressés formant un gazon de 5 à 8 cm., gris d'argent, non ramifiés, épais de 12 à 40μ; sporanges 75-100-112μ de diam., d'abord jaunes ensuite gris foncé; à membrane difluente laissant une collerette et incrustée de cristaux d'oxalate de Ca; columelle sphérique ou piriforme, 24-78μ de diam.; spores elliptiques ou cylindriques, 7-12×4-6μ.

A été isolé du sol en Europe et en Amérique, indiqué aussi en Egypte (Sabet, 1935).

38. **Rhizopus nigricans** Ehrenberg (sect. Ehrenbergia N. Naumov).

J: très fréquent dans la poussière des habitations et du laboratoire; isolé du sol dans le Jardin Botanique de l'Université Hébraique de Jérusalem, sous *Arbutus Andrachne*, par Z. Fisch le 22.IX.1940. Stolons rampants s'implantant dans le substratum par des rhizoides bien développés qui partent de la base du faisceau de 2 à 5 sporangiophores; ces derniers sont assez élévés et non ramifiés. Sporanges hémisphériques, 100-300μ de diam., à columelle volumineuse, sphérique, déprimée, 70-80μ de diam.; spores de forme et de dimensions variables, 9-15×6-8μ. Le développement de ce champignon s'arrête au dessus de 37°C.

Répandu dans le sol dans le monde entier.

39. **Rhizopus nodosus** Namyslowski (sect. Hanzawia N. Naumov).

J: isolé du sol dans le Jardin Botanique de l'Université Hébraique à Jérusalem, sous *Arbutus Andrachne*, le 22.IX.1940, par Z. Fisch. Mycélium formant un feutrage serré, cotonneux, d'abord blanc ensuite jaune-ochre, presque dépourvu de rhizoides, 1-2 mm. de haut; les sporangiophores se trouvent au milieu du mycélium ou sur des stolons et sont souvent renflés en un point quelconque. Si ces renflements sont terminaux, ils donnent naissance à un nouveau groupe de 3-5 sporangiophores. Les sporanges sont ronds, 120-200μ de diam.; columelle sous forme d'entonnoir; spores ovales, anguleuses, 6-9×4-6μ, pourvues de stries longitudinales.

A été isolé du sol en Europe et en Amérique, de même en Egypte (Sabet, 1939).

Specimens seen: Upper Galilee: Banks of Wadi Qurein (1926 EZ); Fam. *PILOBOLOCEAE*

40. Pilobolus Kleinii van Tieghem

J: sur le crottin de chèvres, isolé par A. Fortussoff, Jérusalem, 24.V. 1944. Sporangiophores isolés, 2-4 mm. de haut, partant d'un bulbe napiforme implanté dans le crottin, à contenu orange. Les sporangiophores et la vésicule elliptique sous le sporange ont également un contenu orange. Sporanges noirs, 260-360μ de diam., ne présentant pas de dessin réticulé; spores allongées, colorées en jaune-orange, 10-13×6-8μ, un peu plus petites que ne l'indique la diagnose (12-20×6-10μ). Les sporanges sont projettés à la maturité ensemble avec la columelle.

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THE GENUS *RHAMNUS* IN PALESTINE

By NAOMI FEINBRUN

Upon examination of the Palestinian species of *Rhamnus* in their natural habitats and a study of herbarium collections from Palestine, Syria, Iraq and Egypt the author arrived at the following revision representing a more precise morphological and phytogeographical delimitation of species of *Rhamnus* in Palestine.

The four Palestinian *Rhamnus* species belong to two sections: *Alaternus* and *Cervispina*.

I. Sect. *Alaternus*.

1. *R. Alaternus* L. This Omni-Mediterranean species is found in the Maquis of the Northern part of Palestine, comprising Upper and Lower Galilee, Mt. Carmel, Samaria and Sharon, the district richest in precipitation. Within the Maquis *R. Alaternus* prefers shady slopes and moist ravines and often assumes a tree-like habit. It has not so far been found in Eastern Palestine (Transjordan).

II. Sect. *Cervispina*.

2. *R. punctata* Boiss. Though this species has been recorded by EIG (1932) and given by POST-DINSMORE (1932) from Upper Galilee and Amman, precise data on its occurrence in Palestine and its clear distinction from the more common *R. palaestina* have been lacking. Neither was it mentioned by OPPENHEIMER and EVENARI (1940).

R. punctata is an evergreen shrub easily distinguished from other Palestinian species of *Rhamnus* by its leaves. The leaves are obovate-oblong or elliptical (not spathulate as in *Rhamnus palaestina*), with entire and revolute margins, leathery, tomentulose especially on their lower face and yellowish-grey in colour. The pellucid punctation of the leaves to which the plant owes its name is also present in *R. palaestina*.

R. punctata is confined to a special variety of the *Quercus calliprinos-Pistacia palaestina* Maquis-association which will be described on another occasion and which can be designated as *infectorietosum*. This variety most frequent in Upper Galilee contains *Quercus infectoria* Oliv. as a characteristic species. It has been also recently observed by the author on the summit of Mount Carmel. The same variety is found in the Lebanon where it seems to be the characteristic Maquis-association on hard Cenomanian rock formation and on its product, terra rossa.

R. punctata has not been found south of Mount Carmel. The record from Amman, however, is to be regarded as reliable. Outside Palestine the species is recorded by BOISSIER from Asia Minor, Cyprus, littoral Syria, Lebanon and Anti-Lebanon.

SPECIMENS SEEN: Upper Galilee: Banks of Wadi Qurein (1926 *EZ*); Peki'in (1926 *E*); Ailon (1945 *F*); Montfort (1945 *F*); Jahuleh, Huleh Plain (1924 *E*). Mt. Carmel: Northern slope facing Yagur (1941 *Kushnier*); Mukharaqa, ca. 500 m., *Quercetum calliprini infectorietosum* (1945 *F*).

The species most closely related is the West-Mediterranean *R. oleoides* L. This is one of the many examples of West- and East-Mediterranean vicarious species.

3. *R. palaestina* Boiss. This is the most common species of *Rhamnus* of Palestine found in all Mediterranean Maquis and forests of Palestine, where it sometimes assumes the shape of a small tree. It has been also noted together with *R. punctata* in the Maquis of Upper Galilee. *R. palaestina* is one of the hardiest shrubs, withstanding continued browsing, and is therefore also found in the dwarf-shrub association of *Poterium spinosum*, in much stunted shape.

After having shed its leaves in early winter, *R. palaestina* produces new leaves in early spring. During a warm winter the leaves sometimes persist until new foliation is in progress.

The leaves are spathulate, tapering to a petiole. Their margins are remotely crenate and provided with minute dark glands in the sinuses between the crenules. Contrary to *R. punctata* the leaf margins are not revolute. The leaves may vary considerably in size and shape especially when shaded.

R. palaestina is an endemic of Palestine and Syria and can be designated as an East-Mediterranean species. It does not exceed the limits of the Mediterranean territories.

The record by NABELEK (1923) of *R. kurdica* var. *obcordata* from Wadi Bireh, North of Jerusalem, most probably refers to *R. palaestina*. Not only has *R. kurdica* not been found by Palestinian botanists in Palestine but ecologically the occurrence of this species in Palestine does not seem probable. The author has examined abundant material of *R. kurdica* from Iraqian Kurdistan. That species is a component of the *Quercetum persicae*, an Irano-Turanian deciduous forest. The leaves of that species are tomentulose on their upper and lower faces.

4. *R. disperma* Ehr.

SPECIMEN SEEN: Edom: Petra (1929 *EZ*, sub *R. punctata*); ibid., in Nubian sandstone, 1200 m. (1936 *EFZ*); El Hasma, N of Queira, 800 m., Nubian sandstone (1936 *EFZ*); Naqb Esh-Shtar, 37 km. S of Ma'an, 1400 m. (1936 *EFZ*); E of Wadi Musa, 1500 m. in *Artemisietum Herbae-albae* (1936 *EFZ*); Negev: Wadi Ajram, near Ras-er-Raman, 900-1000 m., bed and rocky slopes; 2 km. N of Ras Abu Serabit, 850 m., limestone rocks; Wari Nefkh, 8 kms. S of Abda, 700 m., rocks (1945 D. ZOHARY).

This species is mentioned here from Palestine for the first time. It has been only recorded from Galala (E Egypt) and from Sinai.

This is an Irano-Turanian species of high plateaux and mountains. In Edom and Negev it has been found at altitudes of 700-1500

m. In S. Galala it was collected by the author together with P. H. DAVIS on the Um Zanatir plateau at ca. 1200 m.

This species is doubtlessly closest to *R. palaestina;* it has similar green narrowly spathulate leaves, deciduous in winter. However, the leaves are entire, destitute both of crenules and of dark glands; they are somewhat more hairy and smaller in size.

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A FIELD METHOD OF MEASURING PLANT TEMPERATURES[1]

By E. Konis

(With 3 figures in the text)

Although the importance of temperature in the life of plants is apparent, our knowledge of the temperature of plants in their natural habitat is scarce, due mainly to certain difficulties in method. The purpose of this paper is to describe an improved thermoelectric apparatus adopted to carry out exact and convenient measurement of plant temperatures under field conditions.

(i) Methods used for measuring plant temperatures

In order to measure plant temperatures investigators formerly employed a mercury thermometer. This method is sometimes still used at present when bodies of great volume are concerned (Viasowski 1927 — thick stalks; McGee 1916 — succulent organs; Zschocke 1931 — juicy fruits). It is especially unsuitable for measurements of leaf temperatures (although v. Guttenberg worked in this way as late as 1927). Therefore efforts were made early to replace the thermometer by a more sensitive and exact measuring apparatus. Already Brown and Wilson (1905) and afterwards Reynolds (1939) and others applied resistance-thermometers. Shreve (1914) used the calorimetric method, which is very exact, but difficult to perform under field conditions.

The thermoelectric method enjoyed the largest repute. It was introduced in botany, according to Leick (1911), already in the first half of the last century. At present it has replaced all other methods owing to its exactness, speed, convenience and suitability for measuring thin organs.

The thermoelectric potential, may be determined in two different ways: (1) The galvanometric method and (2) the potentiometric-galvanometric method.

Each of these methods has its advantages, as well as its limitations (Herrick 1933). The main advantage of the potentiometric method consists in the possibility of using a very sensitive apparatus over a wide range of temperatures. Moreover, the accuracy is almost unaffected by the length of the conducting wires. The disadvantage of this method lies in the great care required for each measurement, which slows down the work considerably.

On the other hand the galvanometric method allows very rapid measurements but the range of measurement must be small if the

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[1] The work was carried out in the Department of Botany of the Hebrew University, under the supervision of Dr. M. Evenary.

sensitivity is to be great. Besides the length of the conducting wires and the temperature of some parts of the apparatus influence the deflection of the galvanometer.

(ii) APPLICATION OF THE GALVANOMETER METHOD IN MEASURING TEMPERATURES OF PLANTS UNDER FIELD CONDITIONS

For measuring plant temperatures under ecological conditions an apparatus is required, which must, besides being exact and quickly read and handled, enable us to carry out measurements of numerous plants, dispersed over an area of considerable extent. Our experience showed that the galvanometric method is most suitable for this purpose. This conclusion was based upon the following facts: The different leaves on one plant do not have identical temperatures (during daytime), owing to differences in exposure, position etc. There exist even minute differences of temperature in the different parts of one leaf. On account of these differences a very exact determination of the temperature of a single leaf is of no value from an ecological point of view, especially if such a measurement is to require a long time (potetiometric method). In this case much more correct values will be obtained if the temperatures of a great number of leaves of one plant are determined rapidly, even though less exactly. Moreover, the temperature of leaves under habitat conditions changes sometimes so quickly that it becomes impossible to determine it by means of the potentiometric method Therefore it is much more advisable under natural conditions to renounce exaggerated exactitude in favour of greater quickness and convenience of determination.

However, when the galvanometric method is used under field conditions certain difficulties are met with. First of these is the dispersal of plants over a large area. This requires the use of long wires, liable to diminish greatly the sensibility of the apparatus. This obstacle has been removed by using a specially built thermocouple, in which the distance between the two junctions is reduced to a minimum. This enables the use of special copper conducting wires which reduce the sensitivity of the apparatus only slightly, even though very long.

Other difficulties are caused by the need to use conductors of different lengths and by the changes of the temperature of some parts of the apparatus (e.g. the galvanometer which is only calibrated for a definite temperature!) during the measurements. These facts influence the deflection of the galvanometer.

These difficulties (as well as the disturbances brought about by the surrounding conditions on the whole) were overcome by checking the calibration (for 2 temperatures) on the place of work every hour. The deviation from the standard calibration was then related to all the values measured during this hour.

It is likewise desirable to adjust a potentiometric set on the

apparatus, in order to increase the range of measuring possibilities (in case of very high temperatures), or for single measurements for special purposes which require maximal accuracy.

(iii) Description of the apparatus and its use

The apparatus was adjusted for use of the galvanometric as well as the potentiometric method.

(1) The thermocouples

Two kinds of thermocouples were applied: Thermocouples for measuring temperature in plant tissues (thermocouple needle); and thermocouples for measuring the surface temperature of the leaves (surface thermocouples) (fig. 1).

Fig. 1. The thermocouples in the thermos flask and the conducting wires connected with them. On the left: The needle-thermocouple; on the right: The surface thermocouple. (The silvering was removed from the thermos flask on the right in order to show the reference junction inside the flask).

The thermocouple needles were made of iron and constantan. A thin injection needle served as iron wire. An insulated constantan wire was passed through the hollow of the needle. On the tip of the needle the insulation was removed and the two wires were soldered together. This point of soldering (test junction; fig. 2, a) is inserted into the plant tissue. The base of the needle is placed into an ebonite stopper. The constantan wire was led through a hole in the stopper. The base of the needle was soldered to another needle of the same kind and this one was passed through a hole of the stopper. Here the needle and the constantan wire were soldered to copper wires. Both points of soldering (reference junctions; fig. 2, b) were adjusted in close vicinity to one another. During measuring they were kept

at a constant temperature of O°C. (melting ice). All parts of the thermocouple inside the thermos flask were covered with paraffine or tar. The ebonite stopper to which the thermocouple was attached was fit into a rubber stopper, which closed a specially prepared small Devar flask. The latter, besides keeping the constant temperature, served as handle for the thermocouple (fig. 1). The copper wires protruded from the ebonite stopper on to its sides. Thus it was possible to connect them by means of screws with thick, insulated copper wires of suitable length which connected the thermocouples with the measuring apparatus. A diagram of a section through such a thermocouple needle was drawn in figure 2.

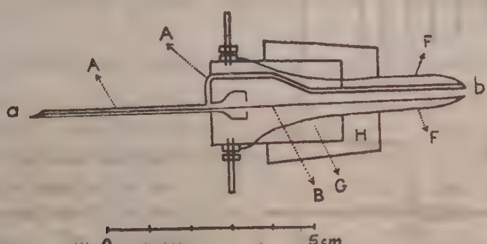

Fig. 2. Diagram of a section through the needle-thermocouple system; a — test junction, b — reference junction; A — the needle (iron thread); B — constantan thread; F — copper connecting wires; G — ebonite stopper; H — rubber stopper.

The thermocouples described have a small internal resistance permitting the use of fairly long copper conducting wires (up to 25 m.).

The construction of the surface thermocouple is much the same as that of the preceding one, the principal differences being the use of a thicker injection needle, acting only as a support, through which two insulated wires of copper and constantan were passed. Before the soldering the end of the wires were flattened in order to get a flat and supple junction which could be brought into close contact with the leaf surface. A small spring clamp, bearing on its end a thin piece of cork, was attached to the needle. The leaf was forced between the test junction on the tip of the needle and the end of the clamp. This adjustment ensured a close contact between the junction and the surface of the leaf (fig. 1 on the right).

(2) *Construction of the measuring apparatus*

The conducting wires connected the thermocouples with the circuit of the measuring apparatus by a selector switch (up to 10 thermocouples may be connected with it simultaneously).

The measuring apparatus itself is built, as shown in fig. 3. It consists of a drum bridge P from the firm Hartmann und Braun (its scale is divided into 1000 units). The potential of the bridge is derived from a 1,5 V dry battery B. The potential is lowered, to the degree required, by resistances. As the tension does not remain constant the current can be regulated by switching the selector switch to the test position and adjusting rheostat R till the galvanometer shows a definite deflection.

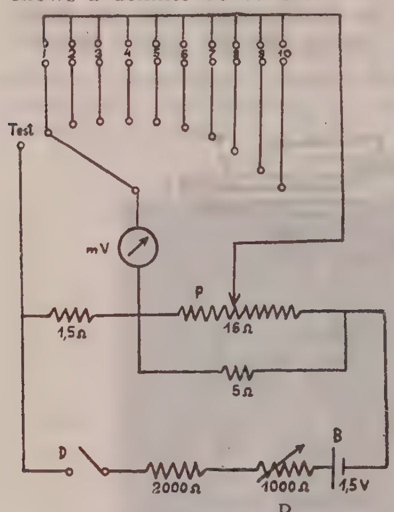

Fig. 3. Diagram showing the construction of the apparatus: P — drum bridge; R — rheostat; B — dry battery; mV — galvanometer; D — circuit breaker; 1, 2 3... — terminals for the thermocouples.

On measuring, the desired thermoelement is intercalated into the circuit by the selector switch[1]. The drum of the bridge is changed until the galvanometer points to O. This is how measurements are executed according to the potentiometric method. In case the galvanometric method is employed, the connection with the battery is interrupted by means of the circuit breaker D and there remain, therefore, in the circuit only the portable galvanometer mV (from the firm Hartmann und Braun, possessing a measuring range of 2 mV and a resistance of 40 Ω), the selector switch and the thermoelements. The magnitude of the potential is read from the scale of the galvanometer.

The galvanometer at our disposal allowed measurements by this method up to an accuracy of 0,2-0,3°C, depending on the length of the connecting wires and the quality of the thermocouple. This accuracy proved to be sufficient for ecologic purposes.

All the parts of the apparatus were mounted in a box fit for transport and for use under field conditions. It had to be placed in the shade at the place of work. With the apparatus described the temperatures of 180 plants were measured in Palestine during a period of 2 years. The apparatus proved to be very convenient

[1] which is seen in fig. 3 above the galvanometer.

and able to perform the tasks required by ecological work. The results will be published later.

(3) *The calibration of the thermocouples*

The calibration of the thermocouples was performed in this way: the temperature of water in a thermos flask (at different temperatures from 0°C to 60°C) was measured by means of a thermometer reading to 0,1°C, the thermocouple was dipped into that water and the corresponding deflection, of the galvanometer or of the bridge was read. The details of the calibration method used are described by Clum (1927). The standard calibration values of each thermocouple were plotted as graphs, which proved to be almost linear.

(iv) Degree of correctness of the measurements

When the temperature of a plant is measured by means of thermoelements, care should be taken that the temperature of the test junction attains that of the body examined. This is realized to some extent already by its small heat capacity. But nevertheless a close contact between the examined body and the thermojunction must be established. The best contact is reached if the junction is introduced into the tissue measured. That is why for measurements usually needle shaped thermocouples, which are easily inserted into the tissues, are chosen. However, needle shaped couples can be used only in organs of considerable thickness. For temperature determinations of thin leaves the employment of this method is technically impossible. Moreover, it is sometimes required to measure the temperature on the very surface of the organ (e.g. in connection with transpiration), and this offers technical difficulties. First of all care must be taken to establish a close contact between the test-junction of the thermocouple and the surface of the plant. Another difficulty in such measurement is due to the fact that only one side of the junction actually touches the plant, the opposite side being at a small distance from the leaf. This problem was thoroughly investigated by Seybold and Brambring (1933). They came to the conclusion that the measurements performed by surface thermocouples are correct, especially if the atmosphere is quiet. Only the following two conditions must be fulfilled: (1) close contact between the junction and the leaf, (2) a delicate and thin junction. If both these conditions be fulfilled, the surface measurements will be correct because of the good heat conduction of the metals and especially because of the formation of a heat field over an organ warmer than the air or a cold-field over an organ colder than the air, respectively. Our surface thermocouple met both these conditions.

Seybold und Brambring proved likewise that the results obtained by measuring the temperatures on the irradiated side of the leaf, are correct. The small extra temperature of the element is of no importance, as it becomes mingled and absorbed in the surrounding heat-field.

A further source of errors in the measuring method by thermocouples in general, the needle-shaped as well as those adapted for the surface measurements, lies in the heat conduction of the wires composing the thermocouple. This factor is liable to falsify the temperature of the test junction, especially in cases where a wide difference of temperatures exists between the plant and its surroundings. Ordinarily it is difficult to remove this obstacle. Fortunately it happens to be easily overcome with bulky organs (fleshy fruits, cactus stems) where overheating is most marked. In these cases almost the whole length of the needle should be introduced into the tissue examined.

When measuring temperatures of leaves it is more difficult to avoid this obstacle. In this case the advice of CURTIS (1936) to establish a contact not only between the leaf and the test-junction, but a great part of the needle as well, should be born in mind.

(v) THE USE OF THE APPARATUS FOR MEASURING THE TEMPERATURE OF THE ENVIRONMENT

The apparatus enables us also to carry out temperature measurements of the soil as well as of the air. The air temperature is determined by means of a needle-shaped thermocouple with large surface, resting under a shade of cardboard and connected with the selector switch of the apparatus.

Temperature of the soil at the surface and at small depths may be measured by the ordinary needle-shaped thermocouples. For larger depths (from 5 cm. onward) a special thermocouple was built, resembling those described above, but reaching a length of 60 cm. The copper and constantan wires composing the couple were much thicker than in the former cases. They were embedded in a metal tube closed at its end by a rifle bullet. The test junction was connected to the inside wall of the bullet, slightly above its tip. The reference junction was placed into an ordinary thermos bottle filled with a mixture of water and ice. At the base of the tube a handle was adjusted which facilitated the insertion of the thermocouple into the soil. Owing to its great heat capacity, this thermocouple required a time of 5 minutes, in order to attain its thermal equilibrium.

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INFECTION EXPERIMENTS WITH AECIOSPORES OF *TRANZSCHELIA PRUNI-SPINOSAE* (PERS.) DIET. IN PALESTINE

By H. E. ZWIRN-HIRSCH

Our knowledge of the life-cycle of the rust *Tranzschelia pruni-spinosae* dates from TRANZSCHEL's experiments of 1905, which established the connection between the rust of stone fruits and the pycnia and aecia on *Anemone* known by the name of *Aecidium punctatum* Pers. TRANZSCHEL infected several species of *Prunus* with aeciospores from *Anemone*, and as a result he obtained urediniospores and teliospores on the leaves of the fruit trees. ED. FISCHER (1904) established two morphological forms of this rust which differ in the appearance of their teliospores: (1) *T. pruni-spinosae* forma *typica*, in which the two cells of the spore are similar in size, colour and echinulation; it is found mostly on wild species of *Prunus*, e. g. *P. spinosa*, *P. insititia*, but also on *P. armeniaca* and *P. domestica*, (2) *T. pruni-spinosae* forma *discolor*, in which the upper cell of the spore is larger, darker and more echinulated than the lower. This form is found on *P. persica*, *P. amygdalus*, *P. armeniaca*, much more seldom on *P. insititia* and *P. domestica*.

DUNEGAN (1938) found in America that the two morphological forms differ also in their life-cycle. *T. pr.-sp.* forma *typica*, which attacks mostly wild species of *Prunus*, completes its life-cycle on wild species of *Ranunculaceae* only (*Anemone*, *Hepatica*, *Ranunculus*, *Thalictrum*). A urediniospore of this form will not pass from a wild to a cultivated species of *Prunus*. On the other hand, aeciospores from cultivated *Anemones* can provoke the disease on cultivated species of *Prunus* only.

In Palestine the rust is distributed widely in its pycnial and aecial stages on the common wild *Anemone*, *A. coronaria* L., and in its uredinial and telial stages on seven different species of *Prunus*: almond, apricot, peach, plum, cherry and others. We attempted to ascertain whether in this country there is any connection between the rusts on *Anemone* and *Prunus*. For this purpose we infected almond, apricot and plum trees with aeciospores from *Anemone* leaves. On almond and apricot there resulted typical infections showing at first uredinia, later telia. The incubation period in experiments started in February was 51 days, in those started in May 18 days; this time is very short compared with the data we have from Europe (3 months). The non-infection of the plum trees was probably due to the fact that this experiment was carried out late in the season, when the aeciospores had already lost some of their germination capacity (although in these late experiments the incubation period was shorter).

After these experiments we examined the herbarium specimens from Palestine, all on cultivated species of *Prunus*, and found that

all of them belonged to the form *discolor;* while our Roumanian specimens (Herbarium Mycologicum Romanicum, Fasc. XVII, Nos. 835, 836, 837, 838, 839) showed forma *discolor* on *P. armeniaca* only, and on wild species of *Prunus* f. *typica.*

In America f. *discolor* attacks cultivated *Anemones* only, among them *A. coronaria* which occurs there only in cultivation. In Palestine *A. coronaria* is the only wild species of *Anemone.* On cultivated anemones we have so far failed to find the aecia. Thus our results agree in principle with those obtained in America. Our form is, therefore, *T. pr.-sp.* f. *discolor* Dunegan.

The aecia on *Anemone* are very common in this country. Their season slightly precedes the appearance of the leaves of the fruit trees; but infected leaves of *Anemone* last much longer than normal ones and are still fresh when the leaves of *Prunus* unfold. Thus it is possible that the full cycle is the usual way of propagation of *T. pruni-spinosae* in Palestine. On the other hand, climatic conditions may permit an overwintering of urediniospores as well. This point deserves further study. It may well be that the full cycle is the rule in the hilly region, where anemones abound in the vicinity of orchards and where trees shed all their leaves in winter, whereas urediniospores are possibly the main means of propagation in the Coastal Plain, where a small number of leaves often remains on the trees and may provide the inoculum in the spring.

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RETAMA DURIAEI (SPACH) WEBB AND ITS PHYTOGEOGRAPHICAL SIGNIFICANCE IN PALESTINE

By M. ZOHARY

Retama Duriaei has apparently up to now been neglected or confused with *R. Roetam,* its closest relative; the only record on this species from Palestine (Dead Sea, Kerak) was given by Boissier (1892). As this species is very abundant in Palestine and vegetationally most significant, we are giving here some of the distinguishing characteristics between the two species concerned.

R. Roetam	*R. Duriaei*
Standard of corolla as long as keel	Standard shorter than keel
Calyx 3-4 mm. long and 3 mm. broad	Calyx 2,5 mm. long and 2 mm. broad
Lateral teeth of calyx acute or mucronate	Lateral teeth of calyx acuminate
Pod oblong-elliptical, gradually ending in a mucro	Pod obovate, abruptly mucronate
Epicarp thick, flesh and strongly wrinkled	Epicarp leathery, smooth
Seeds generally yellow	Seeds generally brown or mottled

R. Roetam is limited to Saharo-Sindian territories and to sandy habitats of the Coastal Plain, penetrating as far north as Beirut. The distribution area of *R. Duriaei* is confined in Palestine to Irano-Turanian territories: it comprises two rather broad belts of the mountain slopes facing the Jordan Valley, one in Cisjordan, the other in Transjordan. These belts are limited in the south by the southern edge of the Dead Sea and in the north by the Beth Shean Valley. Scattered specimens penetrate farther northwards up to the Golan Mountains (Ain Gev at the Lake of Kinnereth). Its area thus comprises the eastern slopes of the Gilboa and Samaria Mountains and of the Judean Desert on the one hand, and the western mountain slopes of Gilead, Amman and Moab on the other. In these regions *R. Duriaei* covers some hundreds of square miles. Its two main centres of abundance and high coverage are the slopes between Wadi Auja and Wadi Malih in Western Palestine, and between Wadi Shuaib (Nimrin) and Wadi Yabes in Transjordan.

Unlike *R. Roetam* which occurs in sand dunes, kurkar hills, Nubian sand-stone, gravelly wadi beds, etc. *R. Duriaei* is mainly confined to hard limestone rocks (mainly Cenomanian).

R. Duriaei is a leading species of several associations. One group of these associations, characteristic of the eastern slopes of the Samarian and Judean Mountains has been classed under the *Retamo-Phlomion brachyodontis* alliance by Eig (1938) who erroneously believed this plant to be *R. Roetam.* In Transjordan *R. Duriaei* is associated with *Rhus tripartita* (Feinbrun and Zohary, 1942). Between Wadi Fara and Wadi Malih it is accompanied by *Periploca aphylla,* a spartoid shrub much resembling *Retama.* In

the Mediterrano-Irano-Turanian transition-areas of Samaria, *Retama* occurs together with *Pistacia Lentiscus;* in other places it sometimes associates with *Zizyphus Lotus* or *Salsola vermiculata* ssp. *villosa.*

Outside Palestine *R. Duriaei* has been recorded from Algeria, Tunisia, Tripolitania, Cyrenaica and Egypt. As to the latter I am very doubtful whether the data recorded by MUSCHLER should be referred to *R. Duriaei.*

From its distribution in Africa and Palestine it is clear that *R. Duriaei* is a species belonging the Irano-Turanian element. Within this element it may be classed under the group of the Mauritano-Steppe plants. This group is represented in Palestine and Syria by a series of species which play a most prominent part in the vegetation of the Irano-Turanian territories, for instance *Artemisia Herba alba, Salsola vermiculata* ssp. *villosa, Noea mucronata, Achillea Santolina, Zizyphus Lotus, Pistacia atlantica, Rhus tripartita, Ephedra Alte* and many others. Moreover, these species as well as *R. Duriaei* appear in Palestine the leading plants in nearly all the Irano-Turanian plant communities, so that the Irano-Turanian cover of vegetation of Palestine and partly also of Syria is practically a Mauritano-Steppe vegetation. This African character of the vegetation may be traced far eastward into Asia until the folded mountains of the Irano-Anatolian Plateau are reached.

These and some other facts have led me to distinguish among the other subregions of the Irano-Turanian region a particular Mauritano-Steppe subregion. This subregion occupies in N. Africa a belt of a considerable breadth, intercalated between the Mediterranean and Saharo-Sindian territories. This belt is interrupted in the East by the Egyptian and Sinaitic deserts where the Saharo-Sindian territory extends as far as the Med. Coast. In Palestine this belt appears again and forms here the above mentioned Irano-Turanian territories.

Although the vegetation of the Mauritanian Steppe has been well described and partly mapped by a series of N. African botanists, no one has referred this belt of steppes to the Irano-Turanian region. EIG (1931) who followed GRISEBACH and attached it to the Saharo-Sindian region had some doubts as to its relationship to the Irano-Turanian region. None of these authorities has considered the fact that Mauritanian Steppe vegetation is most characteristic of the Irano-Turanian parts of Palestine and Syria. Recently, however, REICHERT (1936) from a lichenological and BODENHEIMER (1938) from a zoogeographical point of view included the Mauritanian Steppes of Africa within the Irano-Turanian Region. While it is as yet questionable where to draw the exact eastern boundary of the Mauritanian Steppe vegetation in Asia it is now out of any doubt that the Mauritanian Steppes of Africa, together with their Asiatic continuation (Palestine and Syria) constitute a particular subregion of the Irano-Turanian region closely related to the Mesopotamian subregion but showing only slight floristic connection with the other subregions of this region.

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נסיונות הדבקה בנבגי כוסית של חלדון עצי הפרי הגלעיניים
Tranzschelia pruni-spinosae (Pers.) Diet.

מאת אסתר צוירן־הירש

לחלדון עצי הפרי הגלעיניים מחזור חיים, שחציו עובר בתוך הכלנית וחציו בתוך העלים של עצי פרי מהסוג Prunus. פטריה זו בעלת שתי צורות הנבדלות כלפי חוץ בצורת הנבגים האפילים: (א) forma typica הנמצאת לרוב על מיני בר של Prunus ואינה עוברת (לפי עבודותיו של Dunegan באמריקה) לעצים תרבותיים. גם נבגי הכוסית של צורה זו מוגבלים למיני בר של כלנית. (ב) forma discolor הנמצאת על מינים תרבותיים של Prunus ועל כלניות תרבותיות.

מטרתנו היתה לקבוע האם קים בארץ קשר בין הכוסיות הנפוצות על כלניות הבר שלנו לבין החלדון שעל עצי הפרי הגלעיניים התרבותיים. לשם כך הדבקנו עצי שקד, מישמש ושזיף בנבגי כוסית מהכלנית המצויה, וקבלנו הופעת נבגים בכירים ואפילים על שקד ומישמש. כמו כן קבענו שצורת הפטריה הנפוצה אצלנו היא f. discolor. יש לציין שאת הכלנית המצויה Anemone coronaria מגדלים באמריקה בתור צמח נוי, וגם שם היא משמשת פונדקאי ל־f. discolor.

טרם הוברר אם יש הכרח שמחזור חיה של הפטריה יעבור דרך הכלנית, או שקימת אפשרות לנבגים הבכירים לעבור את החורף בתנאי האקלים שלנו. יתכן שהמחזור השלם הוא השולט בהרים, ואילו בשפלה, במקום שהעצים אינם משירים את כל עליהם יכולה הפטריה לעבור את החורף גם בצורת נבגים בכירים.

רותם הסלעים Retama Duriaei וחשיבותו הפיטוגיאוגרפית בא״י

מאת מ. זהרי

בואסיה היה הראשון שהביא את המין הזה של רותם מסב׳ ים המלח ומכרך בשנת 1892. מאז לא נמסרו שום ידיעות על הצמח הזה בארץ. אין ספק שכל הבוטנאים שעסקו בפלורה של הארץ החליפוהו ברותם המדבר (R. Roetam). רותם הסלעים נפוץ מאד בחבל האירנו־טורני של ארץ־ישראל וממלא תפקיד חשוב בצומח של חבל זה. הוא נמנה על הקבוצה המאוריטנו־ערבתית אשר לאלמנט האירנו־טורני. מעבר לתחומי הארץ הוא ידוע מאלג׳יר, טוניס, טריפוליטניה ומצרים.

מתוך חשובים פיטוגיאוגרפיים מסתבר כי כמעט כל הצמחים הראשיים בחברות האירנו־טורנית של הארץ ממלאים תפקיד חשוב גם בצומח של צפון אפריקה המאוריטנו־ערבתית. דבר זה מעלה על הדעת כי הצומח האירנו־טורני של הארץ הוא קרוב הרבה יותר לזה של אפריקה הצפונית הערבתית מאשר לזה של גוף האזור האירנו־טורני האסיאטי. ולא עוד אלא שיש להבחין באזור האירנו־טורני בן־אזור מיוחד — בן־אזור מאוריטני־ערבתי, שבתוכו כלולים גם החבלים האירנו־טורניים של א״י וסוריה.

טורני, הקשור לתנאי טמפרטורה קיצוניים. במקומות גדולו יורד שלג מדי שנה כמעט.

שיטה למדידת טמפרטורות הצמחים בתנאי שדה

מאת א. קוניס

מדידת טמפרטורת הצמחים בבית הגדול הטבעי נתקלת בקשיים מיתודיים, כי לשם כך נדרש מכשיר, אשר נוסף על דיוקו, מהירות הקריאה בו וקלות הטפול בו, יאפשר מדידות בצמחים רבים המפוזרים על פני שטח גדול. לשם כך הותקן מכשיר תרמואלקטרי שהותאם במיוחד לצרכי עבודה איקולגית. המכשיר הותאם למדידות גם לפי השיטה הגאלואנומטרית וגם לפי השיטה הפוטנציומטרית, אם כי נמצא שבעבודות איקולוגיות שגרתיות מן הראוי להשתמש בשיטה הגאלואנו־מטרית. מבנה המכשיר תואר בציור מס׳ 3 בה מסמן p — גשר תופי מהפירמה Hartmann und Braun; m. V. — גלואנומטר מהטפוס של מראה מהפירמה Hartmann und Braun בעל תחום מדידה של 2 מיליוולט; B — בטריה יבשה בעלת עצמה של 1,5 V המספקת את המתח לגשר; R — ריאוסטט המשמש לווסות המתח; D — מפסק המוציא את הגשר והבטריה מהמעגל; המכשיר יפעל אז לפי השיטה הגלואנומטרית.

באמצעות מפתח הוברו למכשיר תרמוקפלים אחדים (עד 10) בעלי מבנה מיוחד, מהם מחטיים המשמשים למדידת הטמפרטורה בפנים האבר (ציור 1, משמאל) ומהם טרמוקפלים של השטח למדידת הטמפרטורה של פני העלים (ציור 1; מימין; ההכספה הורחקה מהתרמוס כדי לגלות את אלמנט־ההשואה שבתוך התרמוס). פרטי המבנה של תרמוקפל מחטי נתן בציור מס׳ 2, בה מסמן a — אלמנט המדידה, הבא במגע עם הגוף הנמוד; b — אלמנט־ההשואה הנתון בסביבה של טמפרטורה קבועה וידועה, במקרה דידן בתוך קרח נמס (היינו בטמפ׳ של 0°C); A — מחטי זריקות עשויות ברזל (חוט ברזל); B — חוט קונסטנטן; F — חוטי נחושת המחברים את התרמוקפל עם החוטים המוליכים; G — פקק עשוי אבוניט המשמש מסעד למערכת התרמוקפל כולה; H — פקק גומי בו תקוע פקק האבוניט המשמש לסגירת תרמוס המכיל קרח נמס. כפי שרואים בסכימה הנ״ל ובציור מס׳ 2 הוקטן המרחק בין שני האלמנטים של התרמוקפל עד כדי מינימום. דבר זה נתאפשר הודות לכך כי ידית התרמוקפל שעשויה היתה תרמוס קטן שהוכן במיוחד לכך, שמשה בעת ובעונה אחת גם מקום הטמפרטורה הקבועה. כך אופשר השמוש במוליכי נחושת ארוכים גם במדידות הנעשות לפי השטה הגלואנומטרית. הודות לסדור זה והנהגת כיול השואתי במקום העבודה מדי שעה בשעה, אפשר להתגבר על הקשיים המיתודיים שבעבודה איקולוגית במכשיר תרמואלקטרי.

המכשיר הותאם גם למדידת טמפרטורת האויר והקרקע. בדיון על מידת נכונות המדידה בתרמוקפלים השונים הוסק שהמדידות המבוצעות בתרמוקפלים של השטח כשרות כשהאלמנט דק מאד ונמצא במגע אמיץ עם השטח הנבדק. הוא הדין גם במקרה כשנמדדת הטמפרטורה של הצד המוקרן של העלה.

ביחס למשק המים מתנהג השקד כבזבזן, לא כן הזית והחרוב: הם בעלי טרנספירציה קטנה יותר וכל התהליכים שנחקרו בהם הנם חסרי תנודות גדולות.

הזית והחרוב פעילים מבחינה פיסיולוגית במשך כל השנה ואין איפוא מקום לדבר במקרים אלה על „מנוחת קיץ".

תוספת חדשה להכרת הפטריות של ארץ-ישראל (חלק שלישי)

מאת ט. ר י י ס

בעבודה זאת נתן מחקר על 40 פטריות נוספות מקבוצות ה־Archimycetes וה־Phycomycetes, חלקם טפילים על 39 צמחים פונדקאים, וחלקם פטריות שבודדו מהקרקע. 31 מינים נתנים כאן בפעם הראשונה בשביל הארץ. יחד עם 391 מיני פטריות שפרסמנו בעבודותינו הקודמות, עולה מספר המינים שנמצאו על ידינו בארץ ל־422. בעבודה זו מתוארים שלשה מינים חדשים למדע וצורה אחת חדשה והם:

על חומעה ורודה Peronospora Rumicis rosei Rayss sp. nov.
על אספסת עדשתית Peronospora Medicaginis orbicularis Rayss sp. nov.
על בירוניקה לבנה Peronospora Veronicae Cymbalariae Rayss sp. nov.
Actinomucor corymbosus (Harz.) N. Naumov f. palaestina Rayss f. nov.
שבודד מאדמת הגן של האוניברסיטה העברית.

חוץ מזה מובא כאן מספר גדול של פונדקאים חדשים לפטריות הנדונות. כן נתנות בפעם הראשונה פטריות קרקע של הארץ, שלמחקרן אנו מקדישים כעת תשומת לב מיוחדת.

הסוג Rhamnus בארץ-ישראל

מאת נעמי פ י נ ב ר ו ן

לפי הברור האחרון ישנם בארץ 4 מיני Rhamnus והם: R. Alaternus L., R. palaestina Boiss., R. punctata Boiss., R. disperma Ehr.

הנתונים על R. punctata בארץ היו קלושים ובלתי בטוחים, גם בהבחנת המין וגם בהכרת בית גדולו. כפי שהתברר הוא גדל בגליל העליון ובכרמל בתוך חורש מטפוס מיוחד, אשר אפשר לציינו בשם חברת Quercetum calliprini infectorietosum (הוא יתואר בעבודה מיוחדת). בחורש זה הוא נפגש יחד עם R. palaestina אשר ממנו הוא נבדל היטב בעליו שאינם נושרים בחורף ובשפת העלים התמימה והגלולה לאחור (היא אינה חרוקה ובעלת בלוטות קטנות כמו ב־ R. palaestina). העלים שעירים וצבעם אפור־צהבהב. מין זה ידוע היה מסוריה והלבנון, מקפריסין ומאסיה הקטנה.

R. disperma טרם ניתן מהארץ. היה ידוע לפני כן מגללה שבמצרים ומהרי סיני. אצלנו נמצא הוא באדום בגובה שבין 800 עד 1500 מ'. זהו צמח סלעים אירנו־

להכרת משק המים של אלו עצים ים-תיכוניים

מאת א. פוליקוף

עבודה זאת היא פרי חקירה על משק המים של הזית, החרוב והשקד, שנערכה בין ינואר לדצמבר בשנת 1939. נבדקו עצים הגדלים בתנאים טבעיים, בחצר האוניברסיטה העברית ללא השקאה או טפול אחר.

הפנולוגיה של עצי הנסיון סוכמה בעקומה מס׳ 1 על יסוד ההסתכלויות שנעשו באותה שנה.

מערכת השרשים של הזית והחרוב היא שטוחה אבל מפותחת מאד. הודות לה מנצלים עצים אלה שטח קרקע גדול (ראה את שטת השרשים של הזית בלוח A IV). השקד שולח את שרשו הראשי לעומק רב לתוך סדקי הסלע (לוח B IV) ומשום כך מנצל הוא את המים מתוך שכבת קרקע אשר אינה מושפעת מהשנויים האטמוספיריים.

המהלך היומי של הטרנספירציה דומה מאד בשלשת העצים. העקומה היומית האופינית היא בעלת שני שיאים, הראשון בשעות של לפני הצהרים והשני בשעות של אחר הצהרים (עקומה 2). בימים בהם נושבת רוח מזרחית מוצאים עקומות טרנספירציה בעלות שלשה שיאים (עקומה מס׳ 3) או יותר. במשך כל השנה לא מצאנו עקומת טרנספירציה בעלת שיא אחד. בלילה (ובלילות חמסין בכלל זה) אין למעשה טרנספירציה כלל. זו מתחילה רק עם הזריחה ומסתיימת מיד לאחר השקיעה או מספר שעות אחריה.

בדרך כלל קיימת הקבלה בין עקומות הטרנספירציה של צדו המערבי ואלו של צדו המזרחי של העץ (עקומה מס׳ 2). הופעת רוח מזרחית מבטלת הקבלה זו ומתקבלות עקומות מן הטפוס המיוצג בעקומה 4; בעת אשר הטרנספירציה עולה במערבו של העץ, הרי היא יורדת במזרחו, וכן להיפך. שנויים נכרים בעצמת הטרנספירציה מלווים תמיד בתנועת הפיוניות.

טרנספירציה קוטיקולרית בשקד קטנה פי 20—30 מהטרנספירציה דרך הפיוניות. בזית ובחרוב אין לגלותה כלל בשטת „השקילות המהירות".

המהלך השנתי של הטרנספירציה (עקומה 5) בשלשת העצים מתבטא בעקומה בעלת שני שיאים המתאימים לשיאי עקומת ההתאדות.

מתוך השואת העקומות של המהלך השנתי של הטרנספירציה מתברר כי עצמת הטרנספירציה של החרוב והזית היא שוה פחות או יותר והנה קטנה בהשואה לזו של השקד.

עצמת הטרנספירציה במערבו של העץ בשלשת העצים גדולה עפי"ר יותר מזו שבמזרחו.

כח יניקת הקרקע (בעמק של 60 ס"מ) הוא נמוך יותר מאשר הערך האוסמוטי של שלשת העצים ומשום כך גם אינו יכול לשמש גורם מגביל במשק המים שלהם.

הערך האוסמוטי של השקד והחרוב הוא נמוך באופן יחסי ומגיע במקסימום ל־26—29 אטמוספירות, בו בזמן שבזית הערכים הם גבוהים הרבה יותר והערך המקסימלי (42 אטמוספירות) מושג זמן קצר לפני רדת היורה.

עתון לבוטניקה

כרך ג׳ חוב׳ ג׳ סדרת ירושלים כסלו תש״ו

בדיקת המינים של משפחת הסלקיים Chenopodiaceae בא״י והערות על אלו מינים קריטיים של המזרח הקרוב

מאת א. איג

בעבודה זאת נמנים כל המינים של משפחת הסלקיים המיוצגים בתוך האספים של א״י, סוריה, עירק וטורקיה, אשר לעשבית המחלקה לבוטניקה של האוניברסיטה העברית. סוגים אחדים שעד כה לא היו מיניהם מוגדרים כל צרכם ואשר במקרים רבים הופיעו בשמות משובשים הובררו בפעם הזאת ויחסם למינים קרוביהם הואר. דבר זה נעשה ביחוד בסוג Atriplex (ביחוד לגבי המינים: A. palaestinum, A. tataricum, A. leucocladum), בסוג Suaeda (ביחוד לגבי קבוצת המינים S. vermiculata, S. mesopotamica, S. palaestina ועוד), בסוג Salsola (ביחוד לגבי קבוצת המינים S. inermis—S. Autrani וכן גם לגבי החוג הקרוב ל־ Seidlitzia וקבוצת המינים של S. vermiculata, S. villosa, Salsola rigida). מציאותו של הסוג Hypocylix בסוריה בוררה גם היא בעבודה זאת. מתוך הסוג Haloxylon נתבררה חשיבותו של Haloxylon salicornicum בצומח של המדבריות. מתוך החומר של הסוג Halocharis הובדלו שני מינים חדשים למדע.

בעבודה זאת הובאו 7 מינים חדשים למדע והובאו 15 וריטטים חדשים או קומבינציות חדשות. מספר נכר של מינים הובאו כחדשים לארץ־ישראל או לארצות השכנות. אולם נקודת הכובד של העבודה היא ברור זוהותם של המינים הרבים אשר חשיבותם מרובה מבחינה פיטוסוציולוגית, כמו:

Atriplex parvifolium	Suaeda fruticosa
A. leucocladum	S. asphaltica
Salsola Rosmarinus	S. palaestina
S. vermiculata var. villosa	Haloxylon salicornicum
Halogeton alopecuroides	H. articulatum
	Anabasis articulata

כל הצמחים האלה תופסים מקום חשוב ביותר בצומח המדבריות והמלחות של הארץ ורובם הגדול מהוים צמחים ראשים בחברות צמחים חשובות.

עתון לבוטניקה

מופיע בשתי סדרות

א. סדרת ירושלים:

יוצאת לאור ע״י חבר העובדים של המחלקה לבוטניקה באוניברסיטה העברית ירושלים. בכל שנה מופיעות 4 חוברות וכל חוברת נושאת עליה את תאריך הופעתה. כל כרך שנתי מכיל מ־300 עד 400 עמודים.

ב. סדרת רחובות:

יוצאת לאור ע״י ה. ר. אופנהיימר וי. ריכרט של התחנה לחקר החקלאות׳ רחובות, א״י. בכל שנה מופיעות 2 חוברות וכל חוברת נושאת עליה את תאריך הופעתה. כל כרך שנתי מכיל מ־200 עד 250 עמודים.

*

במכתבים הנוגעים לעניני המערכת של סדרת ירושלים יש לפנות לד. ו. זיצ׳ק, ת. ד. 620, ירושלים — ולעניני המערכת של סדרת רחובות לעורכי „עתון לבוטניקה״ ת. ד. 15, רחובות.

*

את דמי החתימה יש לשלם למפרע ע״י שק או המחאת דואר לפי הכתובת: ההנהלה של העתון לבוטניקה ת. ד. 620 ירושלים. מחיר החתימה הוא:

2.000 לא״י לשנה, בעד שתי הסדרת
1.250 לא״י לשנה, בעד סדרת ירושלים בלבד
0.900 לא״י לשנה, בעד סדרת רחובות בלבד
בסכום זה נכללים גם דמי המשלוח.

*

במכתבים עסקיים, בכלל זה הודעה על שנוי כתובת, מודעות וכו׳ יש לפנות להנהלת העתון לבוטניקה ת. ד. 620, ירושלים.

דפוס שהם, תל־אביב

סדרת ירושלים כרך ג׳ חוב׳ ג׳ כסלו תש״ו

עתון לבוטניקה

סדרת ירושלים

יוצא לאור על ידי
חבר העובדים של המחלקה לבוטניקה באוניברסיטה העברית

תכן

ירושלים